THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS

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February 2002

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TC-04 $ 195.00

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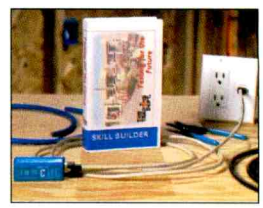

In 45 minutes learn the theory, equipment, and techniques to perform field testing of typical residential infrastructure cables. This video covers static and dynamic testing of TP, coax, and fiber optic cable. It also covers complete certification testing techniques and test equipment for CATEGORY 5 cable.

SB-01 $ 59.00

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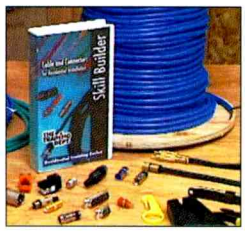

This 1 hour video is designed to teach the professional installer everything they need to know about the cable and connectors used for residential installation, including infrastructure wiring, security, audio, video, and home networks. The video covers cable characteristics and application areas, proper connector use and field and shop connector installation.

SB-05 $ 59.00

FedEx Ground S&H $12.50

Codes, Standards, and Safety Practices
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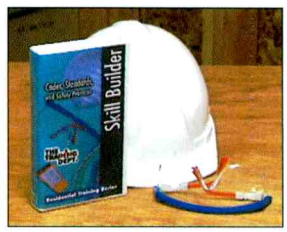

This 45+ minute video covers all codes and standards applicable to residential low-voltage system installation. It includes NEC requirements for grounding, electrical safety, cable listing, OSHA required site safety practices, UBC regulation, as well as TIA, EIA, and IEEE standards that affect residential installation.

SB-04 $ 59.00

FedEx Ground S&H. $12.50

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This 23-minute video introduces the concept of state-of-the-art residential infrastructure wiring, or "structured wiring", and how it is installed and used in the home. It explains the coming wide bandwidth services and why "traditional wiring" is inadequate. It educates the viewer on the benefits and applications that structured wiring brings to the home.

CO-01 $ 29.00

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THE MAGAZINE FOR PROFESSIONAL ELECTRONIC AND COMPUTER SERVICERS

ELECTRONIC Servicing & Technology

Volume 22, No. 2 February 2002

CONTENTS

Electronic Servicing & Technology is edited for servicing professionals and managers who service consumer electronics equipment. This includes owners, managers, service technicians, field service personnel and avid servicing enthusiasts who repair and maintain audio, video, computer and the new digital consumer electronics equipment.

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403 Main Street, 2nd Floor
Port Washington, NY 11050 USA
516-883-3382 Fax 516-883-2162
mmei@mainlymarketing.com

EDITORIAL
Editor: NILS CONRAD PERSSON
P.O. Box 12487, Overland Park, KS 66212
913-492-4857
cpersedit@aol.com

CONSULTING EDITORS
TV Servicing Consultant: BOB ROSE
TV Servicing Consultant: HOMER L. DAVIDSON
Components Consultant: VICTOR MEELDIJK
Audio Consultant: ALVIN G. SYDNOR

BUSINESS
Publisher: MARIE MARCELLINO
mmarcellino@mainlymarketing.com

President: DAVID L. ALLEN
dallen@mainlymarketing.com

CIRCULATION
Circulation Coordinator
Tel: 516-883-3382 admin@mainlymarketing.com

PRODUCTION
Production Manager: MARIANNE MEADOWS
mmeadows@mainlymarketing.com

SALES STAFF
Sales Director: DAVID L. ALLEN
dallen@mainlymarketing.com

Sales: JONI JONES
P.O. Box 346, Port Washington, NY 11050
Tel: 516-944-8068 Fax: 516-944-2739
jmjones@ix.netcom.com

International: JAY FEBRER
jfebrer@mail.com

Classified/Display Classified: LYNDIANE PAOLETTI
Tel: 516-883-3382 admin@mainlymarketing.com

Sales Coordinator: LYNDIANE PAOLETTI
admin@mainlymarketing.com

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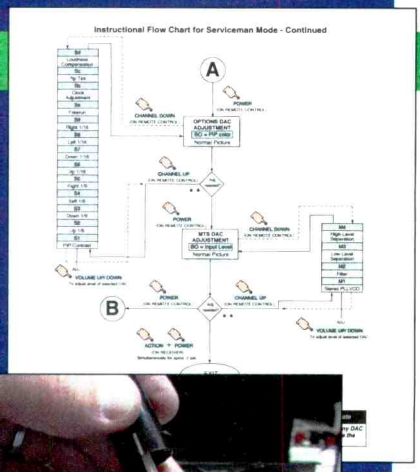
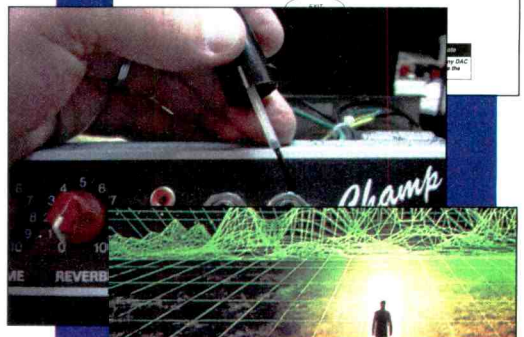
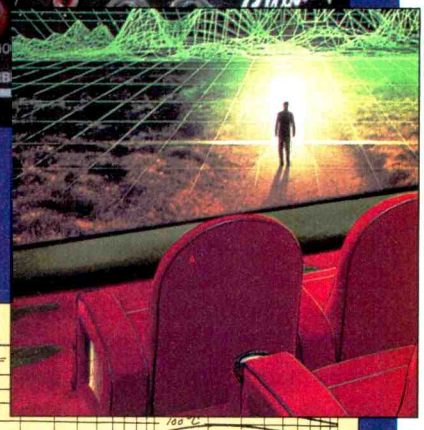
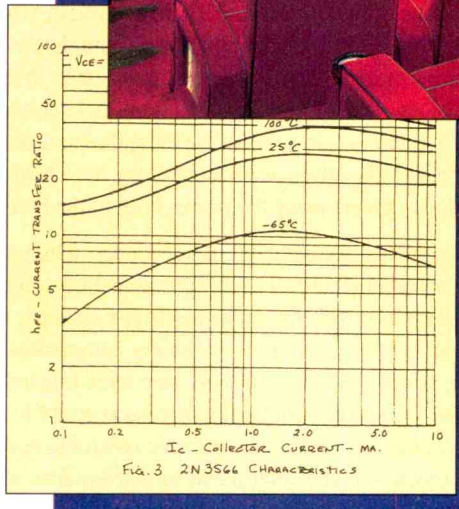
FEATURES









Cover photo courtesy of Theatre Architecture and Design by First Impressions Theme Theatres, Miami, Florida.

DEPARTMENTS

Editorial

by Nils Conrad Persson

EVERYTHING'S ELECTRONIC THESE DAYS

The Consumer Electronics Show (CES) is a good place to go to take the pulse of the industry, to see where things are going in consumer electronics. When you look around at CES these days you can only conclude that electronics is going absolutely everywhere: in photography and photo manipulation and printing, in networking of personal computers in the home, in personal mobile communications, in satellite-based navigation systems, in-home medical devices and a whole lot more.

For example, electronic imaging, which only really began heating up a few years ago has become commonplace: resolution of cameras is getting better by leaps and bounds, and prices are coming down. Moreover, the capacity of the digital media on which those images are stored is increasing rapidly.

Another area in which changes and improvements are being made rapidly is home networking. If you have more than one computer, or internet capable device, in the home, and you want to network them in order to share files, or to be able to access the internet from all of those computers, today you have a variety of ways in which to do that. The most basic, and obvious way to network two or more computers is to connect them via cable, but that requires running cable from room to room, which can be expensive. But electronics companies have come up with other ways in which to connect computers together. There's wireless, which eliminates the need for any kind of wire connection completely. There are networking systems that use the telephone lines already installed in the home: everywhere there's a telephone jack, you can put a computer and use that jack to connect the computer to other computers in the home. Finally, advances in technology have made it possible to network computers using the power lines in the home.

So, what's making all of these wonderful things possible? The root achievement in all of this is ongoing microminiaturization. The smaller it is possible to make electronic circuitry, and the more it is possible to manufacture that circuitry automatically using the integrated circuit process, the more electronic functions that can be added to a product with little increase in cost. For example, one of the big barriers to adding electronic control to real world devices like automobiles, home control and similar applications was the ability to convert a real world analog parameter such as temperature, pressure, speed, into a digital signal that a computer could manipulate. As little as thirty years ago, an analog to digital converter might have taken up as much space as an 8 X 10 piece of paper. Today, that same function can be performed by a tiny integrated circuit package.

Data storage has been similarly enhanced by advances in circuitry. For example, the data capacity of those tiny postage-stamp size memory cards used to store digital images has been constantly increasing. At the show, manufacturers of those units were showing cards that boasted 512Mbytes of data storage. Or, how about this? There's a product called USBDrive that's roughly the size of a house key and that simply plugs into a computer's USB port. It doesn't require driver software. One of these drives can store anywhere from 16Mbytes of data to 1Gbyte.

So why should all of this be of interest to service centers? Simply that much of this new technology affords opportunities for service centers to expand their business into new areas. That said, it should also be said that not all of this technology offers opportunity to service centers, and some service centers will have no interest in pursuing any of these opportunities. However, quite simply, all of this new technology introduces increasing complexity to electronics in the home.

For example, home theater systems, even the inexpensive ones, have a bewildering array of inputs and outputs. Many homeowners just don't have the interest, the technical skills, or the interest in connecting a home theater system. A service center that wants more business might offer a hook-up service to hapless consumers. And don't fool yourself that home theater systems are only going to be found in expensive homes. There are home theater in a box systems that cost less than $300. And while it's logical to think that someone who paid $300 for a home theater system won't want to spend $100 to have it hooked up, it's better for them to spend that additional $100 than to sit there with a $300 system that doesn't work properly, or at all.

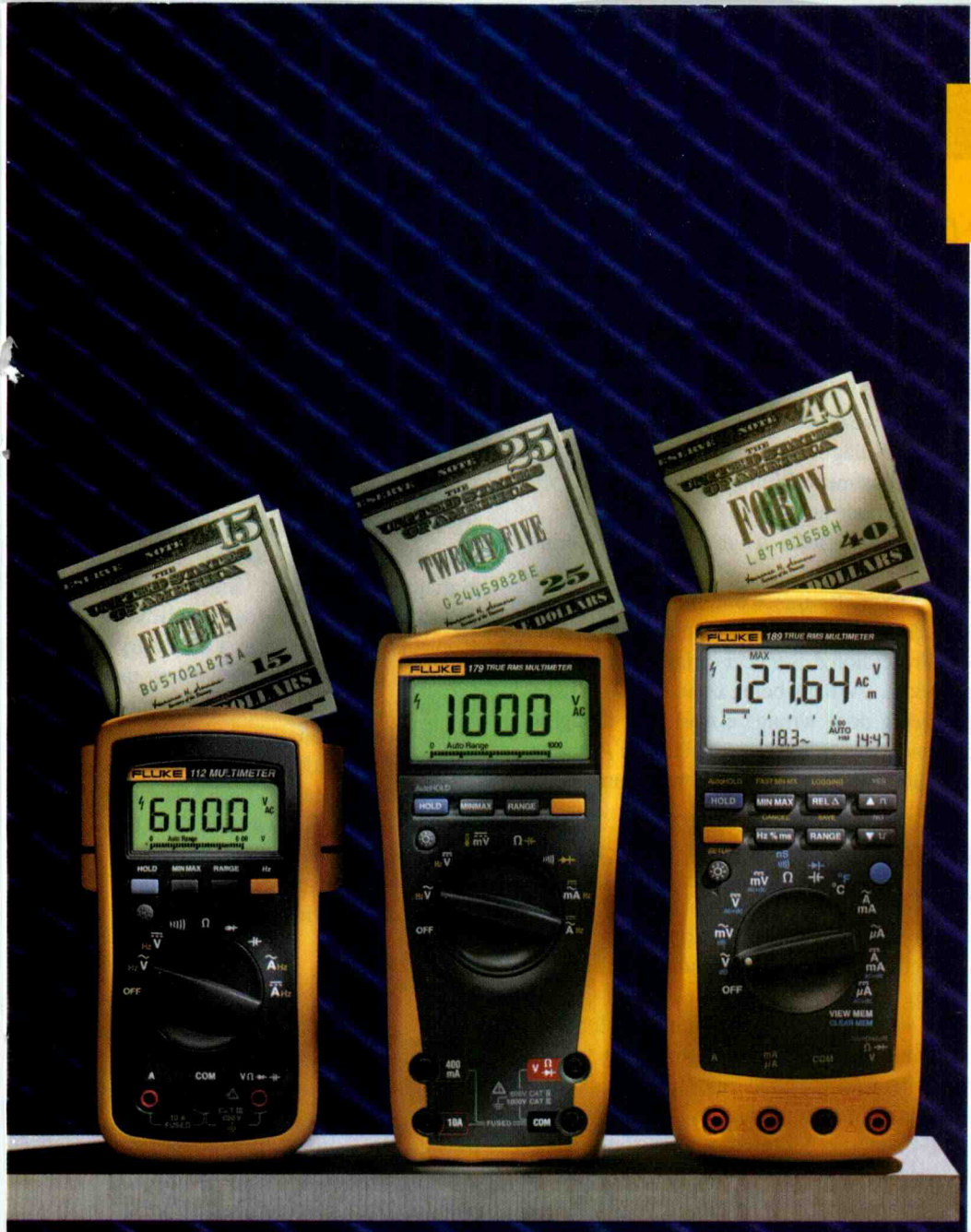
And for those service centers that are contemplating computer service, or who are already doing that type of service, offering computer networking services makes a great deal of sense. As more and more content: audio, video, games, is offered by internet service providers, and as more and more homes are purchasing two or more computers, more homeowners will want to be networked, but may not know how to go about it. An astute service center can make money by offering those services.

Something else that resonates with possibilities for consumer electronics service centers that are willing to get out of the service center and into the homes of their customers and potential customers is the merger of The Consumer Electronics Association (CEA) with the Home Automation & Networking Association (HANA) becam effective January 1, 2002. As a result of this merger, CEA has created a new Home Automation and Networking (HAN) Division for HANA's 500 members, including manufacturers and installers focused on providing the training and support required to develop a successful implementers channel.

Obviously, this merger confirms that the concept of home automation and networking, a scheme in which consumer electronics products are able to communicate with one another, is expected to play an increasing role in residences.

Pure consumer electronics service, in which customers bring in their TVs, VCRs, and the like has declined steadily over the past several years and will probably decline further. However, other opportunities are emerging as a result of changing consumer electronics technology. It would behoove service centers that want to remain in business to keep an eye on some of these trends.

Conrad Persson



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Rules: A check for $15 will be awarded when you purchase a Fluke 110, 111, or 112 meter and send in the invoice or purchase order along with any eligible Fluke meter for trade-in. A check for $25 will be awarded when you purchase a Fluke 175, 177 or 179 meter and send in the invoice or purchase order along with any eligible Fluke meter for trade-in. A check for $40 will be awarded when you purchase a Fluke 187 or 189 meter and send in the invoice or purchase order along with any eligible Fluke meter for trade-in. The meter's model number must be clearly legible on the invoice or purchase order. See #4 above for eligible trade-in models. Limit one trade-in per customer. All trade-in meters must be sent to Rebate Express. Please send your trade-in meter by parcel post and request delivery confirmation. Fluke and Rebate Express will not be responsible for meters lost in shipment. **Do not send trade-in meters to Fluke Corporation or Fluke distributors.** Fluke Corporation and its distributors will not accept trade-in meters. **Non-qualifying meters will not be returned.** All new meters must have been purchased between October 1, 2001 and April 30, 2002. Responses postmarked after April 30, 2002 will not be fulfilled and are invalid and will not be returned. Responses received after May 31, 2002 will be invalid. Allow 8 weeks for delivery. Employees and families (spouses, parents, children and their spouses) of Fluke Corporation, its affiliates, subsidiaries, distributors or representatives, its advertising agencies, rebate supplier and any other company involved with the trade-in offer are not eligible. Trade-in offer good only in the USA and void where prohibited, taxed or otherwise restricted. Only indicated proofs of purchase (sales receipt or purchase order) will be accepted. Limit one trade-in per person. Offer not good with any other special offer or discount. Trade-in checks are not available from Fluke distributors, Fluke sales staff, Fluke service centers or Fluke's corporate offices.

News

Hitachi Service/Engineering Conference

In a continuing effort to improve the serviceability of Hitachi Projection Television products, Hitachi has announce the Service/Engineering Conference, to be held in San Diego in conjunction with their National Dealer Show, May 6-10.

Three delegates (all NESDA members) have been invited to attend, at Hitachi's expense, to review the Hitachi 2002 product line from a service perspective, and visit their Tijuana factory, including our new Plasma TV production facility.

A full day of meetings with our engineers and engineering executives is included. According to Hitachi, the objectives are simple... to recommend design changes that facilitate service for the product, from the service technician's point of view.

Scheduled topics for discussion include, but are not limited to:

- Board vs. component level service . . . can we do both, and how?
- Self-diagnostic possibilities
- Adjustments/alignments via digital interface and laptop
- Improvements in light box removal/reinstallation

To make this Conference even more effective, Hitachi is anxious for any input Professional Servicers may wish to provide... What's being done right? What's being done wrong? e-mail your thoughts and ideas to Walt Herrin, Hitachi America Ltd. walt.herrin@hhea.hitachi.com.

Internet Access Device Market to Grow 41.6 % in 5 Years - Smart Appliances to Lead in Growth

.The worldwide market for Internet Access Devices (personal computers, mobile telephones, Internet set top boxes, and Internet and smart appliances) will grow at an overall annual rate of 41.6% in unit terms between 2000 and 2005, according to Cahners In-Stat/MDR (http://www.instat.com). The high-tech research firm reports that the PC and mobile phone segments currently comprise just over 93% of the industry and will continue to represent the majority throughout the forecast period. While the PC and mobile phone segments will have the greatest unit shipments, smart appliances will have the highest Compound Annual Growth Rate (CAGR) at 100.8%.

"Despite our optimistic forecast for this market, there are still several factors affecting all of its individual segments," says Cindy Wolf, an analyst with In-Stat/MDR. "In the coming years many of these product segments will face increased competition from each other as device functionality converges."

In-Stat/MDR also reported the following observations:

- Though the personal computing device market has taken a beating this year, new products and operating systems will stimulate demand in the coming years.
- Consumers are hesitant to switch to Internet-enabled phones due to security fears, price concerns, and the lack of compelling applications.
- Internet set top boxes are confronted with challenges in broadband penetration, consumer education, and operator business models.
- The Internet appliance market has seen the exit of many players primarily due to price and application issues, but there appear to be opportunities in vertical markets.
- The smart appliance market is being hampered by a lack of standards, high prices, and a lack of consumer education on how the products add value.

The report, "Forecast and Analysis of the Worldwide Internet Access Device Market: 2000-2005" (#ID0107AD), analyzes and forecasts the worldwide Internet Access Device industry. Worldwide unit shipments for the period of 2000-2005 are forecasted for each segment. Market dynamics, market leaders, and recent announcements are also summarized.

IntelliNet Controls ends OEM Operations

IntelliNet Controls, developer of whole house audio and energy management systems, has announced that it will be ceasing all OEM business by the middle of the year. "In light of the recent acquisition there is an urgent need to refocus our efforts in improving IntelliNet Controls' market position"; stated Sergio Batista, Director of Market and Product Planning for IntelliNet Controls. "We see this as a necessary business decision that will allow us to strengthen our inner structure while focusing on growing our market share" he added.

IntelliNet Controls, which started out in Naples, FL, was acquired by Russound in December, 2001, and moved to it new facilities in Newmarket, NH in late January 2002.

Zenith Digital At CES 2002

Reflecting an aggressive approach to Digital Television (DTV), Zenith unveiled its new product line at CES 2002 including a broadened family of plasma and LCD screens and an attractively priced series of integrated direct-view flat-screen HDTV models designed to accelerate the DTV transition.

Building on its 2001 announcements towards digital leadership, Zenith made a strong digital statement at the 2002 Consumer Electronics Show with a comprehensive family of digital television products, from big to small, flat to thin.

Zenith's CES booth, located near the main entrance to the Las Vegas Convention Center, emphasized their 2002 marketing theme, "Digitize the Experience," and showcased their new widescreen plasma display panels (PDPs), expanded lineup of liquid crystal display (LCD) digital TV monitors, and products intended to make HDTV more widely available.

HAI Celebrates 17 Years of Success by Acknowledging its 2002 Five Star Dealers

HAI, manufacturer of integrated automation and security products since 1985, announced the winners of its Five Star Dealer program for 2002 at the EH Expo in Orlando, FL. The announcement was made in conjunction with HAI's 17-year anniversary.

The annual Five Star Dealer program was initiated last year by HAI to recognize and reward outstanding HAI dealers. "We're honored to celebrate our anniversary by publicly acknowledging and thanking some of the dealers responsible for our success and longevity", explained HAI President, Jay McLellan.

HAI 2002 Five Star Dealer JJ Henderson of Hargray company in Hilton Head, SC accepts congratulations from HAI President Jay McLellan during the 2002 EH Expo in Orlando, FL

Winners were selected based on various criteria, including the number of years the Dealer has been installing HAI products, number of systems installed in the year 2001, and unique marketing or programming solutions that involved an HAI product.

HAI products are sold through a worldwide network of Distributors and installed by over 1000 trained dealers.

The companies named as 2002 HAI Five Star Dealers are:

7 Seas Technologies, Inc - VA
Aditel Electronic Systems - Italy
Advanced Home Integration - PA
Advanced Home Systems - Canada
Advanced Residential Systems - PA
Advanced Systems - NV
Aegis Security, Inc - AZ
Aggressive Home Automation & Design- NJ
Allsafe Security, Inc - TX
American Automation & Com.ns, Inc -MD
Atronic Alarms, Inc - KS
August Systems - MO
Automated Home & Office Technologies - OH
Automated Home Technologies, LLC - TN
Automated Homes of New England - MD
Automation Design & Entertainment, Inc - MI
Automazione Casa SRL - Italy
Avir, Inc - CA
Big Edison - MI
Brinn Electric, Inc - NC
CBI Systems, Inc - KY
Circuits Plus - MN
Conitec - Italy
Connect Tech, Inc. - NJ
CST - TX
Custom Audio Video/Advanced Automation - LA
Custom Audio Works - TX
Custom Entertainment, Inc - IL
Cybermation, Inc - MN
Cybernetics - Canada
Diversified Technologies, Inc - MD
Edwards Security - Canada
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Vision Systems, Inc - CO
Voltrix, LLC - GA
Westco Home Systems - MS
Wiley Systems - NC
Willett Wiring/ Total Home Entertainment - GA
Z-Technologies, Inc - FL

EDS Board Nominated

Dan Parks, president of West Electronic Sales Team, Huntington Beach CA, has been slated for election to a first term on the Board of Directors of the Electronic Distribution Show corporation. He will represent the manufacturers' representative function on the EDS Board, succeeding Clark Moulthrop, Moultrhop Sales, Pleasanton CA, who has completed the maximum six years of service. Four other Board members have been reslated for second three-year terms. David Herring, Projections Unlimited Inc, Tustin CA (current EDS president), will continue to be one of the four distributor directors: John Denslinger, Murata, and Richard Russell, Tech-Spray, will be spokesmen for the manufacturer community; and Mike Kunz, R.W. Kunz Company, St. Louis, will continue as a representative director.

Directors are recommended by the three EDS sponsoring associations, ECA, ERA, and NEDA. All serve on the not-for-profit board without compensation.

The slate will be presented for election May 16th, the concluding day of EDS.

Bits and Pieces...

Servicing systems, policies and predictions continue to be in a state of flux.

Recently, *Bits and Pieces* has heard that **Sears** has cut back their service center in Pittsburgh and many repairs are being sent to Baltimore.

Sears has also opened a repair facility just south of Boston. Speculation is that they are working towards large regional repair depots rather than offering local repairs.

In addition, **Radio Shack** has closed their repair facility just outside Pittsburgh.

In the meantime **Sony** has embarked on a "do it ourselves" service set up in a number of communities throughout the country, offering flat rate pricing for in home service.

Bluetooth Chips Kick Butt

Bluetooth is definitely a reality, with chipset shipments on track to meet a previous 2001 forecast of 13 million, according to Cahners In-Stat Group (http://www.instat.com). The high-tech market research firm reports that the excellent shipment results this year, in spite of the economic climate and recent events, helps to further cement the fact that Bluetooth is here to stay. As a result, Bluetooth chipsets this year will double those of 802.11b.

"Activity has moved forward in the mobile phone, notebook PC, and adapter space, with specialty adapters just beginning to show up for Personal Digital Assistants (PDAs)," says Joyce Putscher, a Director with In-Stat. "Once people are educated on what the benefits are, demand will rise for products that include Bluetooth connectivity, as long as prices of products are reasonable. The challenge lies in getting the message across, and being able to educate the general public correctly in a variety of ways and channels."

In-Stat also reports that:

- Misrepresented issues about Bluetooth this year have not had any significant impact regarding real industry development, nor relationships between the Bluetooth chip vendors and their customers. Driven by consumer and equipment vendor demands for Bluetooth-enabled devices, the semiconductor opportunity in this area will be substantial.
- On the carrier side, wireless providers indicate that they have an interest in and are evaluating deployment of Bluetooth access points and networks. Japan, Korea, and Europe are ahead of the curve, with respect to carrier deployments and enterprise Bluetooth access point deployment plans.
- Taking into account the economic slump, Bluetooth chipset shipments will still rise sharply to 780 million units in 2005.

The report, "Bluetooth Overtakes 802.11x with 2001 Shipments on Track" (#MM0118BW) provides an interim Bluetooth forecast update that looks at units, chipset integration, revenue, application and geographic segmentations.

Web Engineering Exercises

In 1995 when the World Wide Web was still a novelty, a Johns Hopkins University electrical engineering professor Wilson J. Rugh began posting interactive multimedia exercises and quizzes to help students succeed in an area of engineering called Signals, Systems and Control.

Today, Rugh's free site offers 19 on line learning modules accessed by thousands of novice engineers around the world. Some colleges incorporate Rugh's Exercises into their curriculum: in other instances, engineering students log onto the exercises independently for learning assistance.

Tribute Paid to Rugh

At the recent Frontiers in Education Conference in Reno, NV, engineering educators and industry executives paid tribute to Rugh's site, naming it the recipient of the 2001 Premier Award for Excellence in Engineering Education Courseware. The award is sponsored by Johns Wiley & Sons, Autodesk, Math Works and Microsoft Research.

Rugh's Site, called "demonstrations in Signals, Systems and Control. Operates on the web at http://www.jhu.edu/~signals.

Activist Groups Claim High-Tech Toxic Trash from USA Found to be Flooding Asia.

A report by an international coalition of environmental organizations claims that huge quantities of hazardous electronic wastes (E-Wastes) are being exported to China, Pakistan, and India where they are processed in operations that are extremely harmful to human health and the environment. The organizations-Basel Action Network (BAN) and the Silicon Valley Toxics Coalition (SVTC), with support from Toxics Link India, Greenpeace China and SCOPE (Pakistan) have released a report on their claims entitled: Exporting Harm: The High Tech Trashing of Asia.

According to BAN their investigation uncovered an entire area know as Guiyu in Guangdong Province, along the Lianjiang River (4 hours NE of Hong Kong) , where approximately 100,000 migrant workers are employed breaking apart and processing obsolete computers imported primarily from North America.

The operations involved men, women and children involved in such tasks as open burning of plastics and wires, riverbank acid works to extract gold, melting and burning of toxic soldered circuit boards, and the cracking and dumping of lead laden cathode-ray tubes. The team claimed witnessing tons of E-Waste simply being dumped along rivers, open fields and irrigation canals in the rice growing area. The pollution of the Guiyu has become so devastating that well water is no longer drinkable and water must be trucked in form 30 kilometers away.

"We found a cyber-age nightmare," said Jim Puckett, coordinator of BAN. "They call this recycling, but it is really dumping by another name...We further discovered that rather than banning it, the US government is actually encouraging this ugly trade in order to avoid finding real solutions to the massive tide of obsolete computer waste generated in the US Daily."

"Consumers in the US have been the principal beneficiaries of the high-tech revolution and we simply can't allow the resulting high environmental price to be pushed off on the others" said Ted Smith, Executive Director of SVTC, "Rather than sweeping our E-Waste crisis out the back door by exporting it to the poor of the world, we have got to address it square in the face and solve it at home, in this country, at its manufacturing source."

Their report can be found at www.ban.org. and at www.svtc.org.

Troubleshooting Transistor Bias Circuits By Design

by Alvin G. Sydnor

At times it is very difficult to convince an electronics technician the importance of knowing how a circuit is designed and its intended purpose. The knowledge of why a specific transistor must behave in a certain way to give the desired results of the device being serviced gives the technician the ability to interpret the voltage and current measurements in any circuit. I have heard it time and again "I have a schematic but there are no voltages given except the power supply."

Some of the reasons technicians shy away from studying circuit design is that either the mathematical calculations are too complex or they feel there is no reason since they will not be designing circuits. Before we get started I would like to refer you to one of my earlier articles "Voltage Breakdown in Transistors" that appeared in the July 1986 issue of ES&T.

What is Bias?

One of the most surprising things about troubleshooting electronic circuits is the lack of the basic knowledge of bias. Also keep in mind that no two technicians will perform the same measurements and tests when troubleshooting the same device.

Bias is not new in electronic circuits and even in today's advanced designs its use is still important in controlling the proper function of even the most complex circuits. The function of bias in electrical and electronic circuits is to establish an electrical reference level and set the necessary operating point of a component or circuit. As an example of why proper bias is important, if the bias voltages for a transistor are set properly, it will operate in the linear region of the characteristic curve and will operate with a minimum of distortion. On the other hand, if a transistor (or diode, or vacuum tube) operates on the non-linear portion of the characteristic curve, the result may be bias distortion.

One of the basic problems in both the design and troubleshooting of electronic circuits is establishing and maintaining the proper collector to emitter voltage and emitter current (often referred to as biasing conditions) in the circuit being tested. It is very important that proper biasing conditions be maintained despite variations in ambient temperature, variations in gain and leakage between transistors of the same type.

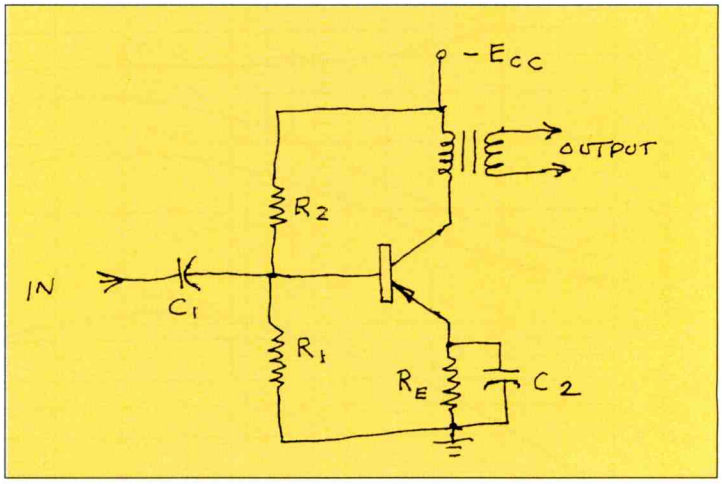

Figure 1. Common-emitter Amplifier Configuartion

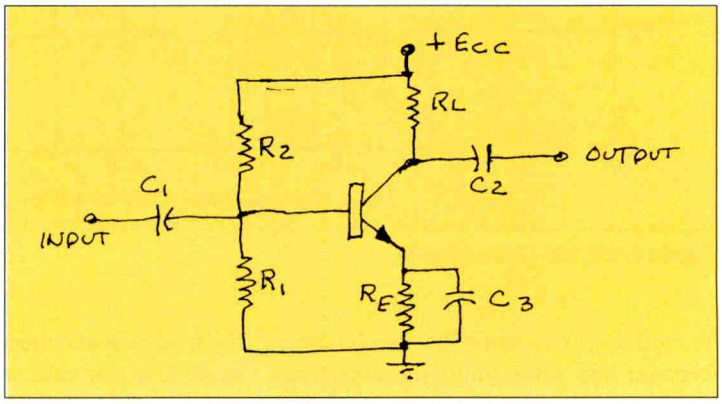

Figure 2. Design technique using N-P-N Transistor.

Some Important Factors

The following are important factors of which the service technician must be aware:

1. Make sure that the maximum and minimum values of current and voltage are correct for the particular transistor.

2. Bias circuits are designed to provide the minimum value of collector leakage current to be zero and the maximum value is obtained from the transistor's specifications.

3. Under normal operating conditions, the base-emitter voltage for germanium transistors should be about 0.2V and for silicon transistors about 0.7V.

4. The tolerances of the voltage and resistor values of the bias network.

Using Ohms Law

Here we will be concerned with the bias, or dc operating point, of transistor amplifiers. The circuit configuration shown in Figure 1 is a typical pnp amplifier connected in a common-emitter configuration using transformer coupled output. The voltage divider formed by resistors R1 and R2 develops the bias necessary. The dc emitter current divides between the collector and base circuit according to the ratio of Ic to Ib or the value of hFE, which is called the dc forward current transfer ratio. This value can be found in the transistor data sheet.

In Figure 1 the emitter resistor RE is used for stability and it also develops a certain amount of negative feedback. The degree of bias stability is determined by the ratio of R1 and RE. The larger the value of RE the better the current stabili-

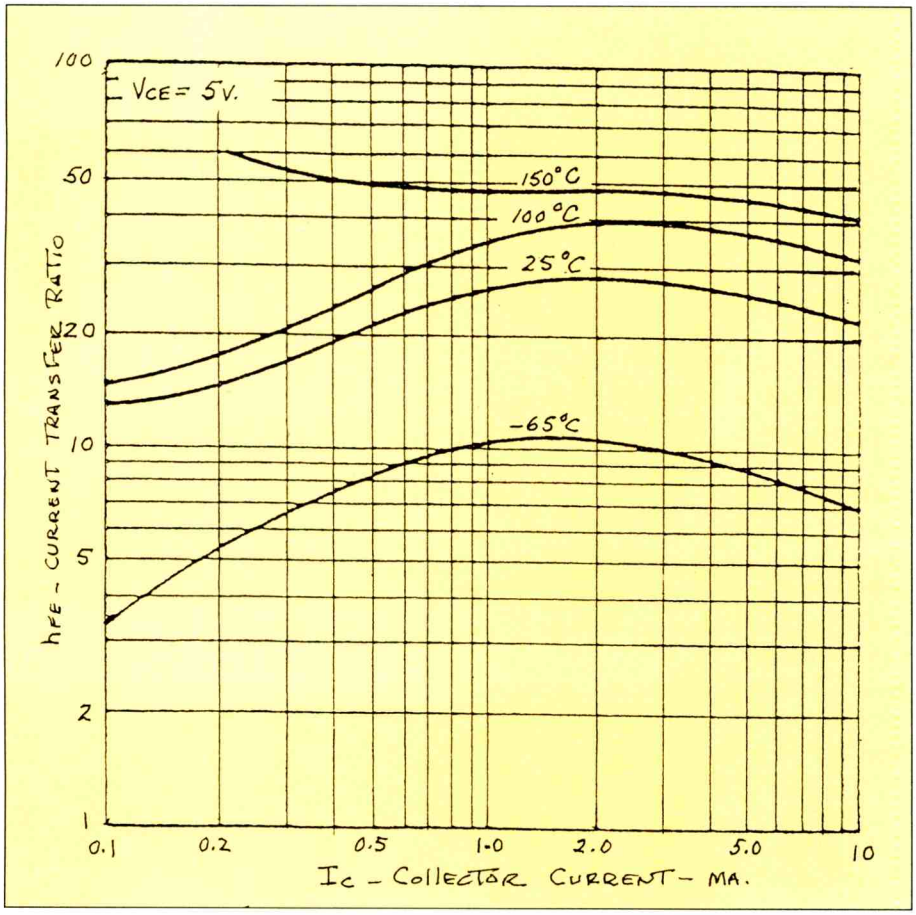

Figure 3. 2N3566 Characteristics.

ty will be. You must be careful here because this value limits the maximum output signal and the amount of emitter current that can flow. Therefore the choice of RE must be a compromise determined by the value of the emitter current desired, the load impedance, and other factors pertaining to the particular circuit applications.

The Method

Its important to illustrate the problems involved in bias circuit design. As an example we will look at a popular npn transistor being used in a common type of transistor amplifier as illustrated in Figure 2. The first consideration we must look at is the value of ECC, which will be determined by the type of application, power supply available and the maximum collector voltage specified by the manufacturer.

Let us assume we are using a 2N3566 transistor whose data sheet list the maximum allowable collector-to-base voltage as 45V. In our case we will let ECC be equal to 40V. Next we will choose the value of the emitter current, and in this case the maximum value of emitter current allowed for this transistor is 25mA. If the signal-to- noise ratio is important, the emitter current must be kept at a low level for a more favorable signal-to-noise-ratio. If maximum power is wanted, a larger emitter-current is necessary. Before we establish a value of emitter-current we will look at the graph of hFE, versus collector current shown in Figure 3. Looking at the graph it can be seen that at a temperature of 25∞C, the transistor can be operated effectively between 1mA and 5mA. If an emitter operating point of 3mA is chosen, the result should be satisfactory for most applications.

When the emitter resistor is bypassed with C8, the emitter can be considered to be at a constant dc potential as the ac signal variations will be filtered out. If the dc drop across RE has been determined, the value of RE can be calculated. The larger the percentage of ECC dropped across the emitter resistor, the more stable the amplifier is with respect to changes in temperature and its associated effects. It must be kept in mind that efficiency will decrease and the voltage drop across RE will be lost, as far as voltage available for ac signal amplification is concerned. In practical applications the voltage across RE will be about 19 percent to 40 percent of the supply voltage. We will compromise again and let ERE be equal to 20 percent of ECC, or 8V.

If the emitter current is 3mA, and the drop across RE is 8V, then RE can be calculated: RE = ERE/IE, or RE = 8V/3mA = 2667©. The closest standard resistor value to 2667 © is 2700©, which will be used. Now we will calculate the actual voltage drop across RE which is ERE = 2700© x 3mA = 8.1V. which leaves 31.9V across the transistor itself and the load resistor RL.

Under ideal operating conditions (which very seldom happens) the voltage drop across the transistor itself and RL would be equal, in the absence of any signal input. Such a condition would allow the collector voltage to increase and decrease an equal amount with a signal input, thus giving minimum distortion. However, as IC will increase if the operating temperature increases, certain precautions must be taken. Therefore, the voltage drop across the transistor will be made a little larger than ERL as a safeguard against increases in ICBO (collector leakage current) and HFE.

If ERL plus the voltage drop across the transistor is 31.9V, or approximately 0.80 of ECC, ERL can be assigned an arbitrary value of 0.35, this leaves the voltage across the transistor at approximately 0.45 thus ECC and ERL at 14V.

The voltage drop across the transistor is 31.9V minus 14V, or 17.9V, thus we achieved the necessary relationships. Because I is approximately the same value as IE: is Ic= 3ma., RL = ERL / Ic. or RL = 14V/3mA or 4667©. The closest standard resistor value to 4667 is 4700©.

Under our design conditions there can be an increase of IC due to the changes in

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Circle (2) on Reply Card

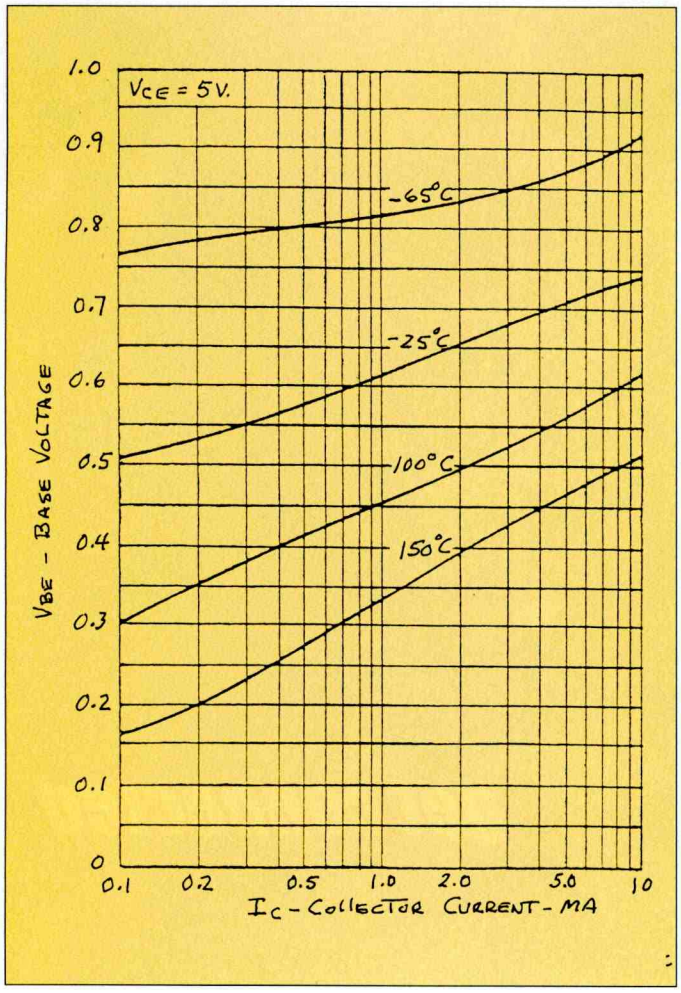

Figure 3. 2N3566 Characteristics.

ICBO, hFE or RER (emitter-to-base-resistance) of approximately (17.9V - 14V)/RL without having an adverse effect on the circuit. With RL equal to 4700©, the allowable increase in IC is 3.9VD 4700© or 0.83mA. With the low voltage of ICBO for a 2N333, this should be sufficient protection against any possible changes in the bias operating point.

Now we want to determine the value of the base voltage, which must be slightly more positive than the emitter in an npn transistor. The base-emitter voltage (VBE) versus collector current(IC) can be determined from the graph shown in Figure 4. At a temperature of 25∞C and a collector current of 3mA., VBE is seen to be approximately 0.68V, therefore the base dc voltage with respect to ground is 8.1V plus 0.68V or 8.78V.

Current Stability:

Because the values of R1 and R2 as shown in Figure 2 will determine the current stability. A very useful stability equation is: St P% 1 D (RE/R1 + 1hFB), where St is the current stability factor and hFB is the dc forward current transfer ratio for a common-base amplifier.

Resistor R1 is usually much smaller than R2, the ratio of RE to R1 is the factor that determines the current stability of the circuit. If St of 5 is wanted, making R1 about six times larger than RE can closely approach it. In this case: 6 x RE P% 16,200©. The closest 10% standard value for R1 would be 15,000 ©, and R2 can now be calculated. With 8.78V across R1, the current through R1 is IR1 P% 8.78"15,000 = approximately 0.585mA. Going back to Figure 3 we see that at 25∞C, with a collector current of 3mA, hFE is equal to 28.

Now that we know the value of hFE and the collector current, (the collector current is approximately equal to the emitter current), we can now calculate IB. The parameter hFE is equal to the dc collector current divided by the dc base current or IB = Ic"hFE or 3mA"28 which is about 0.107mA.

Because IR2 is equal to IR1 + IB, IR2 = 0.585mA + 0.107mA = 0.692mA. The voltage across R2 is: ER2 = Ecc - ER1 or 31.22V. Next we will calculate R2. Since R2 = ER2 " IR2, it is equal to 31.22VD 0.692mA, or approximately 45,000©. Again going to the nearest standard value for R2, that value would be would be 47,000©.

From the values we have come up with we can now calculate the current stability factor: Sf = 1"(RE D R1 + RE " R2 + 1 + hFB) and hFB P% "Hfb D (1+ Hfe) or - 28 " 29 or - 0.964. Sf = 1"(2700 D 15,000 + 2700 " 45,000 + 0.036) or 3.7

Here we came out with 3.7 as our current stability factor. That is much better than our goal of 5. When your calculations come out below the goal you can make the values of R1 and R2 larger if a larger stability factor can be tolerated. Keep in mind that for every value for RE there are an infinite number of values for R1 and R2. As the values of R1 and R2 are made smaller, the Sf improves but the current drains from Ecc increases, as does the shunting effect on the ac input signal. So we can say that the values of R1 and R2 are compromises. There were several parameters such as IE and RE that were chosen instead of being calculated this is a normal design procedure. There is no single value for these components.

What is important to the service technician as well as the design engineer to keep in mind is that semiconductor device parameters vary. As an example, the value of hFE (the forward current transfer ratio) for a 2N3566 will vary from 18 to 40 as shown on one data sheet and hFB has a similar range. Also note that we selected standard off the shelf values and used "approximate" quite often.

Its a good idea to measure voltage drops across components as well as emitter, base and collector while looking and comparing the transistor data sheet. If you determine that a transistor is defective you must determine what caused the transistor to go. As an example, I recently found a base resistor whose value had dropped 75% causing sufficient current to flow resulting in permanent damage to the transistor. Replacing the transistor without checking the base resistor would have resulted in another transistor failure.

Another important point to keep in mind is that germanium transistors have a much larger ICBO than silicon units so greater precautions must be taken to insure that germanium transistors are operating well within their specifications. ■

Rear Projection

Adapted with permission from the book "Complete Projection TV Troubleshooting and Repair" by Joe Desposito and Kevin Garabedian, ISBN 0-7906-1134-1.

Disassembly and Re-Assembly

The disassembly needed to arrive at the point where you can start troubleshooting varies. A typical projection TV consists of five or more separate PC boards as well as the CRTs, lenses and mirrors. The PC boards are mounted both horizontally and vertically. In older sets, which you are more likely to be servicing, the boards are connected to each other with many wires. In newer models, PC board subassemblies are connected to a main PC board through a socket on the main board.

Remember, one of the chief reasons for disassembly is so that you-the technician-can take a suspect PC board out of the projection TV. You need to troubleshoot and repair the board-from the foil side on your bench. There are other reasons, as well. Sometimes you will need to examine the CRTs and lenses, or clean the reflecting mirror in a rear projection model, or make adjustments.

A rear projection TV such as the NEC PJ4680S has five major PC boards, which you can get at through the lower rear part of the cabinet. These are the Video IF/Sound IF/MPX, Power Supply/ Audio/Video, Deflection/Convergence, Input/Output, and Tuning printed circuit boards. If you have the service manual for the set, it will tell you where all these boards are located in the television. If not, you can find out yourself by inspection. You may be able to figure out the function of a particular board simply by looking at the components on that board. For example, if you see a flyback transformer on a board, you know this is the deflection board.

If you are not certain about the function of the board, it's easy enough to read the markings on the board. For example, a board may be marked VIF/SIF/MPX. This tells you the board handles the video IF, sound IF and MPX (multiplex) signals. In this case, the tuner is built into this board. This part is easily recognized by its shielded enclosure. Don't confuse the tuner with the tuning printed circuit board

To remove a board from the cabinet, you first have to remove a myriad of wires from the board and then unclip or unscrew the board from the cabinet. Each wire is clearly labeled with a name that corresponds to a connector on the PC board. Thus, you don't have to worry about labeling the wires yourself. You may remove a board from the cabinet while you are in the field and bring it back to the shop for repair, or if you cannot determine which board is causing the problem, you have no choice but to transport the entire set back to the service center. For now, we will assume that the TV is in the service center for repair.

Repairing a projection TV is not just a matter of finding the source of the problem and replacing the defective part. Any repair starts with disassembly. You may think this simply means removing the rear cover of the TV.
In some cases this is true. But, most of the time there is further disassembly of the electronics inside the cabinet. At the outset of this article, we will cover the steps typically needed, over and above the troubleshooting process, to complete the repair.

For a rear projection TV, if you find that the repair will require a lot of disassembly, it is best to hoist the projection TV onto a bench. Use a bench other than your workbench, since you will need your workbench to make measurements, do soldering, and so forth. With the projection TV at eye level, you don't have to strain your back removing and replacing wires.

Disassembly sometimes means disconnecting the circuits of the projection TV from the CRTs. To do this, you must disconnect three sockets, which are attached to CRT PC boards, from the necks of the CRTs. You need to exercise great care when doing this so as not to damage the necks of the picture tubes. You may also have to remove the anode caps from the CRTs.

Some projection TV manufacturers use CRTs with anode caps that are permanently attached to the tube. You should not attempt to remove these. You'll find these CRTs in some NEC projection TVs.

After a repair is completed, you will often have to do further disassembly to perform maintenance procedures. The mirror in a rear projection TV should be cleaned before you return the set to the customer. To get at the mirror, you have to unscrew its cover and remove it from the cabinet. The cover and mirror will come off together. The mirror can then be cleaned with any window cleaning product.

Re-assembly of the projection TV is, obviously, the opposite of disassembly. Reassembly requires that you remember all the steps involved in disassembly, which is sometimes difficult to do. If you think you may forget the disassembly steps you may want to make some drawings and diagrams or even take a few Polaroid photos. These will assist in the re-assembly process.

Practical repair Techniques

It is not uncornmon during disassembly and re-assembly to break off a wire or otherwise damage the TV When you put the projection TV back into operation, you may find a problem different from the original one. For example, if you break off a wire going to one of the CRT boards, you may find that the TV is missing a

color when you perform the final checkout. Don't despair if this is the case. You are probably not looking at a major repair, but more likely just soldering a wire back into place.

Handling the Projection TV

After doing an initial inspection from the front of the TV, you will have to turn the TV around and remove the back cover to take a look inside. As you know, rear projection TVs are large, so you will need some room to maneuver the set. When the set is rotated enough, you can remove the rear cover. If you are lucky, you will be able to notice the cause of the problem right away and fix it on the spot. Or you may be certain where the trouble lies and be able to remove only one or two boards to bring back to your service center .

If you can't figure out the cause of the problem, you will have to transport the set to your service center usually in a van or small truck. For this, you will need a helper to move the TV up or down stairs and out the door. A small hand truck is perfect for this job. These have rubber wheels to help with the stairs. If the hand truck has a strap, that is even better because it holds the TV tightly and you can maneuver it through the stairs. A good hand truck will help you avoid scratching the TV. Projection TVs are not very heavy but they are bulky. If you are strong enough, you can even move the TV yourself using a hand truck. A magnesium hand truck is the best to use, because it is light and maneuverable.

If you are doing a repair on your own TV or for a friend, you may have the luxury of leaving the TV in place. Remember, though, troubleshooting and finding the problem may take an hour or more. If you are servicing a customer, it's best to remove the set from the premises rather than take the chance of spending a great deal of time at a home or at the place of business.

During the initial inspection, don't be afraid to disengage PC boards and look at the foil side if you need to. Be careful not to break wires that connect one board to another. But even if you happen to break one, these breaks are usually easy to repair. Remember, the more access you have to the projection TV circuits, the better able you will be to make a decision about the repair.

Replacing Components

Let's move ahead a little now. Let's assume you have removed the appropriate PC board from the TV, made a few measurements, and found the cause of the problem. Now you have to replace one or more components to make the repair.

Replacing components is a straightforward job if the projection TV has a standard printed circuit board and standard components; in other words, no surface mount devices. Once you gain experience, removing solder with a desoldering tool or a solder wick is relatively easy. You remove the solder from the leads of the component, and the component comes out very easily. You should not exert force to remove components; this can easily damage them.

Integrated circuits are more difficult to remove than components such as diodes and transistors, since they have more leads. A microprocessor, for example, typically has 60 or more leads. But, you can remove ICs the same way you remove other components. Simply remove the solder from all the pins of the IC and then pry it out of the PC board, usually with a small flathead screwdriver. Again, do not exert any unreasonable force. If an IC is completely desoldered, it will come out without too much effort on your part.

Sometimes, components will have a mechanical attachment to the PC board in addition to the solder. This occurs during the manufacturing process when a component's leads are bent after insertion into the holes on the PC board. You may have to use a small screwdriver or a long-nose pliers to undo the mechanical bond while you are melting the solder with an iron.

To do the job right, the PC board should be in a convenient position for desoldering. Usually, this means the board is upside down with the foil side facing you. If you try to desolder a component while the board is still in the projection TV, you have to maneuver the board so that the foil side is facing you.

Surface-mount devices are a different breed of component. First, you have to use a solder wick to release the solder. Then, you have to pry the component from the printed circuit board, because it is glued to the board at the factory. The glue is used

to hold components before they are soldered in place. Usually, this glue is designed to fracture when the component is twisted.

To insert a new component, position it properly on the printed circuit board, then solder it using a very small soldering iron and a small amount of solder.

Surface-mount integrated circuits are more difficult to remove and replace. These tiny ICs have pins on all four sides. In order to release the solder on all the rows of pins simultaneously, you need a special soldering iron that is shaped like the IC. The iron is placed on top of the IC and it desolders all of pins at the same time with a vacuum pump action.

Another way to remove surface-mount ICs is by removing the solder with a solder wick very carefully and then prying them up with a small flathead screwdriver. You have to do this very carefully so as not to break the copper traces. The traces are very thin and very easy to break.

Replacing surface-mount devices is a time consuming and difficult operation. An alternative to removing a defective surface-mount component is to replace the entire board. This is obviously a much more expensive way to do a repair.

Repairing Cracked Solder Joints

Cracked or broken solder joints can completely disable a projection TV. The cracks may occur during operation of the set, in which case you have to track them down. Or, you may inadvertently break a joint or pad during the course of a repair.

Simple cracks and cold solder joints can be repaired by melting the old solder with an iron and adding a bit of new solder to the joint. More involved cracks, possibly of a pad or trace, are best fixed by soldering a jumper wire to the PC board. The jumper wire takes the place of the broken or cracked pad or trace.

The cathode-ray tube, or CRT, is a fairly reliable component in today's projection TVs. But just like anything else, it has its own share of troubles. In terms of servicing, it is very rare that you would want to replace any of the CRTs, since the cost of each is about $400. But there are certain procedures you can perform to correct problems with the CRT.

Overview of a CRT

The CRT is a vacuum tube with an electronic gun or cathode that emits electrons when heated by a filament. The electrons travel through the tube and eventually hit a phosphorescent material on the face of the tube to produce light.

A series of grids inside the tube are used to accelerate and control the electron beam. In a typical projection television, the first grid of the CRT (G1) controls the brightness of the display you see on the screen. The second grid (G2) accelerates

the electrons. The third grid (G3) focuses the electrons. The anode delivers high voltage from the high-voltage transformer to the picture tube.

In a projection TV, the CRT is directly connected to a magnifying lens assembly. The lens assembly can be disconnected from the CRT. The plastic lenses are protected from the heat of the CRT by a cooling radiator filled with transparent antifreeze. This antifreeze can sometimes be the source of problems in a projection TV.

Troubleshooting the CRT

There are many different ways to check out a CRT. Some tests demand specialized equipment, such as a CRT tester; others can be done with a DMM or pattern generator. Some measurements can be made with the front cover of the projection TV removed. Other tests must be done with one or all three of the CRTs removed from the set. In this section, we explain how to perform these tests.

Using a CRT Tester

If you suspect a problem with a CRT and you have a CRT tester you can check the condition of each CRT. If you find that there is a short between the grids and the filament, which is a common problem, then you can try to burn away that short with the tester. If you are successful, you can prolong the life of the CRT.

You may find that the guns of the three CRTs are not emitting electrons at the same level. In other words, one gun has a higher emission than another (the guns have to be within 10% of each other). You can try to clean one of the cathodes of one of the picture tubes by applying a voltage to it. This voltage burns the oxide accumulation on the cathode so that it can again release a large quantity of electrons. Cleaning is a low-power process.

If cleaning doesn't help, you can try rejuvenation. Rejuvenation applies an even higher voltage to the cathode. This may be successful, but may also make matters worse. If a picture tube is completely worn out, it is impossible to rejuvenate it. In this case, the only solution is to replace the defective CRT.

Measuring CRT Voltages

Any time you suspect a problem with a CRT, you should measure its working volt-ages. This will help you decide if the CRT is at fault. The trouble may be caused by one or more voltages supplied to the CRT. If the voltages are not correct, the image on the CRT display will look bad.

You must pay close attention to the level of the voltages on the CRT pins. You need to know the screen voltage on G2 and the focus voltage on G3. The focus voltage is very tricky to measure. You can't do it with a DMM; you need the proper tool; a high-voltage probe. You also need to know the magnitude of the voltage that goes to the anode of the CRT. You need a high-voltage probe for this measurement, too. You can't measure this voltage with a DMM.

The screen voltage is the most important one. It can make the screen look very bright or very dark. It has to be around 400V. This voltage can be adjusted with the screen control, which is located in various places on projection TVs. The screen voltage control of the NEC PJ-4680S is on a screen block in the set. If you can't find this control in the set you are working on, you will have to purchase the service manual.

The anode charges the whole inside front portion of the picture tube, so that it accelerates the beam. The electrons released from the cathode need energy to travel the distance to the face of the CRT and strike the phosphor. The face of the CRT is at a positive voltage so it attracts the electrons.

Testing the Yoke

The yoke is actually a double coil consisting of horizontal and vertical deflection coils. The horizontal coil has very low resistance, approximately 1 ohm.

The vertical coil has a slightly higher resistance, approximately 14 ohms to 24 ohms. This is the way to distinguish one coil from the other. Simply measure the resistance of each coil with the DMM set to ohms.

When the television is working and voltage is applied to the yoke, it creates a magnetic field around the neck of the picture tube. That magnetic field deflects the beam on the face of the picture tube.

You need to be concerned about convergence if you change one of the picture tubes or if you change the yoke. In other words, you'll have to deal with convergence if you disrupt the manufacturer's settings.

Adjusting the convergence in a projection TV can be very time consuming. Additionally, the procedure varies from manufacturer to manufacturer. Basically, the procedure involves two steps: static convergence and dynamic convergence. If you want to do the adjustment correctly, you really should purchase the service manual for the television you are repairing. The service manual explains this process in detail.

Adjusting Magnet Rings

On the outside of the picture tube are magnet rings used to position the beam. The only time you really need to worry about centering magnets is if you replace the yoke or the CRT. To save yourself time, before you take a magnet assembly off the neck of a CRT, use a marker to mark the position of the magnet on the CRT.

Checking the Lens Assembly

The lens is a mechanical assembly and will not cause any problems. However, since a coolant is used to cool the lenses, there is a chance that the coolant may leak. Usually the leak is caused by a defective head gasket between the radiator and the face of the CRT. This gasket is inexpensive and can be replaced easily. The coolant must be replaced, too.

Other CRT Repair Techniques

If you have tried to clean or rejuvenate a CRT without success, you may want to try another approach. You can use a small isolation transformer to increase the filament voltage from 6.3V to about 7V. This way, the weak cathode of the picture tube will be heated to a higher temperature and will release more electrons. Although this technique might improve the picture, it is only a temporary fix.

Here is another technique you may want to try in a pinch. Most televisions use a filament voltage that is derived from the secondary of the flyback transformer. Sometimes, you may have a short between the filament and one of the cathodes, for example, the green cathode. If this happens, the green color will be out of control because the filament is changing the bias. The best thing to do in a case like this is to eliminate the bias caused by the shorted filament.

To do this, you have to cut the CRT socket adapter from the copper side of the CRT board. Then, you have to attach a small isolation transformer in between the copper trace and the CRT socket. This isolation transformer is very similar to a booster transformer. The only difference is that the isolation transformer not only provides the voltage, but it separates the filament of the CRT from the secondary of the flyback transformer. There is no physical connection. This way, even though there is a short between the cathode and the filament, the bias doesn't change because the filament is no longer grounded.

There are many ways to control the image you see on a television's screen. Some controls are accessible from outside the TV meant to be adjusted by the end user. Others are internal controls, meant to be adjusted by a technician. If the controls are working, you can use them to keep the TV in peak operating condition. If not, you have to know how to repair them, since a defective control can render the set useless.

Checking Analog Controls

Analog controls can be either external or internal controls. If external, an analog control is usually a shaft that turns a potentiometer. If internal, an analog control is usually a small potentiometer that can be adjusted with a small screwdriver. Analog controls usually are clearly marked on the printed circuit board and also in the service manual.

If you turn a control and nothing happens, you can be sure that there is a problem somewhere in the circuit. The first thing to check is the control itself. The value of the control is marked on the top, for example, 103 means 10,000 ohms. If you suspect the control is bad, disconnect it from the circuit and measure the value of the resistance. If it doesn't match the value stamped on the part, you should replace it. Controls rarely break down completely, but sometimes they get dirty. You have to spray them with contact cleaner; lubricate them a little bit. Be gentle with small potentiometers. Don't force them, because they break easily

If the potentiometer is in good condition, then you have to check the rest of the control circuit. Check the connections, check all the transistors, and check if the circuit is getting power. This procedure should help you track down the problem.

Checking Digital Controls

Many of the newer projection TVs have digital controls. These are external controls available to the end user and to the technician. The technician controls are accessible by punching in a special code on the handheld remote control unit.

Projection TVs with digital controls often employ pushbutton switches, which are typically located on the front panel. These pushbuttons connect to a microprocessor, usually located on the main PC board or a separate control board.

The output of the microprocessor is a digital signal that is converted to an analog voltage. This voltage increases or decreases according to the length of time the button is depressed (until maximum or minimum values are reached). This voltage is then applied to a particular circuit to make the required adjustment. So, instead of turning a potentiometer control to change the voltage that goes to a certain circuit, pressing a pushbutton control (closing a switch) sends a digital signal to the microprocessor. The microprocessor then sends a signal to a digital-to-analog converter, which in turn produces an appropriate voltage that goes to the circuit that it controls. The same effect is accomplished in a different way.

If you have a problem with digital controls, there is a possibility that the microprocessor is bad, but it is more likely that one of the pushbutton switches is stuck or dirty. To make a quick check of a pushbutton switch, gently push it in. You should hear and feel the distinctive click of the switch. If you feel the click, the pushbutton is most likely in working condition.

The microprocessor accepts only one input at a time, so if one control is stuck in the ON position, none of the other controls will work. This is because the microprocessor is working on the command that is pressed (stuck). Microprocessors used in projection TVs typically cannot handle more than one command at a time.

If a pushbutton switch is dirty, it will not make contact. You have to take out the switch and measure it with the ohms function of a DMM. This will tell you if the switch is making contact or not. If the switch measures infinite resistance when you push it in, it is not making contact. If dirt is the cause, you have to clean it with contact cleaner. If the switch is broken mechanically, then you have to replace it.

Any time you check a digital control that is not working, make sure to check that the digital-to-analog converter is getting power. If the converter is not being powered, the microprocessor may send the signal, but the voltage will not change.

Although the external controls of a projection TV may make use of a microprocessor, internal controls may still use potentiometers, which are usually on the main board, on the CRT board, and so forth. This is how the technician can fine tune the TV. On the newest digital projection TVs, there are no internal controls whatsoever. All the controls are available through the service menu, which you access by entering a code into the handheld remote control unit. In order to find out the code, you need either the service manual or you have to call the manufacturer.

Checking the Pincushion Control

The pincushion control takes care of any bowing that may occur at the right and left sides of the picture on the projection TV's display. When this circuit is working, adjusting the potentiometer or pressing the digital control will bring the picture back to its proper rectangular shape. If you find that this control is not

working, you have to check the transistors and related voltages and controls of the pincushion circuit. If you cannot locate the pincushion control in a particular set, you will have to order the service manual.

Checking the Brightness and Contrast Controls

The brightness control of a projection TV changes the level of the voltage at the brightness control input of the video IC. The output of this IC connects to each of the three CRTs to control the brightness.

The brightness control does not affect the level of the video signal that goes to the picture tube. In other words, brightness directly controls the picture tube's capacity to produce more light.

The contrast control of a projection TV changes the level of the voltage at the contrast control input of the video IC. This actually changes the level of the video signal. If you keep the level of the contrast constant and increase the brightness, eventually the picture becomes washed out and very dim. There must be a balance between the contrast and the brightness to obtain the most acceptable picture.

Checking the Focus Control

The display of a brand new projection TV is very sharp. You can see all the details. Over the years, the CRTs wear down and the picture loses its focus slowly but steadily. After years of service, the display can become blurred.

Sometimes you can successfully adjust the focus, sometimes not. It depends on the condition of the CRT. Typically, the focus adjustment is an internal control, not available on the outside of the TV.

Once you remove the rear cover of the set, you can locate the focus adjustments on the body of the high-voltage block. As mentioned earlier, this block contains six controls. Three controls are markedfocus, the other three controls are marked screen.

Before adjusting the focus, you should put a test pattern on the screen by pressing the test button. Then, use the convergence control to offset the three beams. Then, slowly turn each focus control to the left and to the right. By watching each line of color go from blurry to sharp and back to blurry again, you will be able to gauge the maximum sharpness of each CRT. If the sharpness is acceptable, leave the control in that position. This is all you need to do to adjust the focus.

If you cannot get a decent sharpness, it means either the picture tubes are worn out and beyond adjustment or one or more focus controls are burned out. If the latter is the case, you have no other choice but to change the high-voltage block.

One other problem can crop up. You may achieve an acceptable focus adjustment, but it will not remain in focus for very long~maybe a few days. This is also an indication that the high-voltage block needs to be replaced.

The focus voltage is generated by the flyback transformer and through a resistor divider network is lowered to about 5,000V. By turning the focus control, you change the value of the voltage until you achieve the best possible sharpness.

Adjusting the Gray Scale Background

In order to produce color, a projection TV has three CRTs. In theory, the three CRTs are exactly the same; but, in reality, there are slight differences. To compensate for these differences, the manufacturer always provides screen controls.

To make the adjustment, you need a tool like a video generator that provides a gray background pattern. Once the pattern is on the screen, you adjust the color control so that there is no color. Then, you vary the screen controls slightly until you obtain absolute gray. These screen controls are the same ones described in the previous section.

It is very difficult, if not impossible, to do a color alignment by displaying colors on the screen. The alignment has to be done with the gray background, without any trace of color in the picture.

The Power Supply

The power supply of a projection TV is the source of many electrical problems. Why is this so? The power supply is subject to many of the conditions that make electronic components unreliable. Electrical surges and heat are two prime examples. The power supply usually takes the brunt of any electrical surge in the ac line. It takes the first punch, in a sense. Heat buildup in the power supply often dries out capacitors, causing them to fail. If you turn on the power and see no response (the picture does not come on), check whether the television is plugged in. If it is, you need to check if there is a problem with the power supply.

In this section, we cover the two most common types of power supplies: linear and switch mode. We'll cover the switch mode supply in greater detail, since this type of supply is more prevalent in today's projection TVs.

Linear Power Supplies

Linear power supplies are an older type of supply, but are still used in some late model projection TVs. Linear power supplies are not very efficient and weigh a lot, but they are easy to build and are reliable.

The linear supply employs a standard stepdown transformer. The transformer serves two functions. It lowers the voltage, and it provides isolation between the primary side, which is connected to the ac line, and the secondary side. Since more than one voltage is needed by the television, the secondary of the transformer has several secondary windings that produce different voltages.

On the secondary winding side of the transformer can be bridge, full-wave and halfwave rectifiers. The bridge rectifier is the most efficient, allowing a smaller filter capacitor to be used. Most projection TVs with linear supplies use all three kinds of rectifiers.

A bridge rectifier is constructed with four diodes. These diodes may be discrete or housed in a single package that looks like an integrated circuit. A full-wave rectifier is constructed with two diodes. A halfwave rectifier employs just one diode. All three types rectify the ac and produce a dc voltage. This dc voltage is filtered by a capacitor and then fed to a regulator, which regulates the outgoing voltage.

The supply may have one or more voltage regulators depending on the number

of voltages required for operation of the television. Connected to the output of each regulator is a capacitor typically rated at about 100uF. The reason for this capacitor is that the voltage needs to be filtered. The capacitor filters out any ripple in the voltage. The filtered voltages from the regulators are then applied to the various circuits in the TV.

When repairing a projection TV, if you notice that the fuse is blown on the primary side of the power supply, it means that the transformer is taking excessive current. It is not wise to simply replace the fuse and power up the TV again. Instead, it's a good idea to check the full-wave rectifier, diodes and zener diodes on the secondary side of the transformer. If one of these components is shorted out, excessive current flows to ground and blows the fuse.

Problems in a linear power supply are fairly easy to spot. With a DMM set to the ohmmeter range, you can measure each component to find out if there are any shorts. The repair work is straightforward. It is not something that requires special tools or test equipment. All you have to do is desolder the shorted component and replace it with a new one.

Switch Mode Power Supplies

Switch mode power supplies do the same kind of job as linear supplies, but in a different, more efficient way. As mentioned, in a linear supply, first there is a transformer, then a rectifier, then a regulator. In a switch mode supply, first there is a rectifier, then a transformer. Regulation in a switch mode supply is accomplished by feeding back part of the output to the input. The transformers used in switch mode supplies are called flyback transformers or switch mode transformers. They are much lighter than the transformers used in linear supplies due to the higher frequencies used to drive these transformers. shows the schematic diagram of a typical switch mode power supply. This is from the Panasonic PTG-4062R projection TV.

In a switch mode power supply, 120Vac from the electrical line passes through an if filter and is fed to a bridge rectifier (D910-D913 in the schematic). This converts the voltage to approximately 150Vdc. This high voltage is converted back to ac by a switching transistor, in this case, Q914. A switching transistor turns on and off, on and off, thus producing the ac voltage. This voltage is fed to the flyback or switch mode transformer (T91 1). The secondary of this transformer produces several different voltages, which are rectified by four half-wave rectifiers (D923, D924, D925, D927) and made available to the various circuits of the television.

In a switch mode power supply, regulation is accomplished by controlling the ratio of the on-time to off-time of the switching transistor. This is done through feedback circuitry. In one type of switched mode power supply, the voltage is regulated by a regulation control integrated circuit, which, through feedback from the primary of the switching transformer, regulates the output voltages. In other switchmode power supplies, you may find that the feedback is through optoisolators, due to the different grounds of the primary and secondary of the transformer.

The feedback voltages are fed to the gate of the switching transistor (Q914), through 1C910. This IC controls the regulation of the on and off cycle (pulse width) of the switching transistor. This technique is called pulse width modulation (PWM). Controlling the pulse width determines how long the transistor will stay on and how long it stays off. This method adjusts the voltage in the secondary to be at a constant level, which is preset by the reference voltage.

An optoisolator is used in some power supply designs because the primary of the power supply has a hot ground, which is connected to the electrical ground. The secondary has a separate ground. There is no way to interface between the two grounds. One way is with an optoisolator, which has a very high isolation voltage, about 5,000V. The feedback works through the optoisolator to adjust the outgoing voltage. In this circuit, though, the two grounds are separated only by the switch mode transformer, since the feedback is built into a separate primary coil.

Why do you need feedback? When the switching transistor is on, energy is stored in the transformer. When the transistor is off, the energy from the transformer is released. This is the way the switch mode power supply works. When the load connected to the secondary increases, the switching control IC or transistor extends the on-time of the pulse so that the output transistor stays on longer. When the current drops down again, the on-time of the pulse is decreased, so the output transistor stays off longer.

The difficulty in servicing switch mode power supplies stems from the fact that they are so-called closed loop circuits, because they use a feedback voltage. A typical problem in a projection TV is a blown fuse. Replacing the fuse rarely solves the problem. Obviously, some-

thing has caused the fuse to blow.

The first component to check is the bridge rectifier. If this is okay, then check the switching transistor. The switching transistor can be damaged by lightning, by spikes in the electrical line, or by overloading. If the switching transistor is good, then you may either put in a new fuse or connect a socketed 100W light bulb between the leads of the fuse holder (in place of the fuse) to find out how the supply is going to react.

A switch mode power supply is a self-contained unit in many TVs. You may take the supply out of the television and service it separately on the bench. You don't need the rest of the TV, because all the voltages produced by the power supply are fairly independent from the load. If you use the light bulb and there is a problem in the feedback loop, the light bulb will shine brightly. In a good power supply, the light bulb will be very dim, you will hardly see any light.

If there is no voltage in the secondary, then it is a little more difficult to service the supply, since all the voltages are interrelated. You have to start checking component by component; there is no other way. Check the switching transistor, check the IC, check the reference zeners, all the rectifiers in the secondary, and so on. There must be a reason that the power supply won't turn on.

Sometimes, there is a short in the secondary so the switching transistor never turns on. Sometimes, a rectifier in the secondary will short out, burn up a resistor, and destroy the switching transistor. Sometimes, but rarely, the optoisolator (if there is one) or one of the error detector transistors goes bad. Capacitors sometimes dry up and don't filter the secondary voltage, so there is no feedback coming to the optoisolator in that type of supply. These capacitors in the secondary are most likely to fail. The capacitors are warmed by the heat from the trans-former and the heatsink of the switching transistor when the television is operating. After years of use, the capacitors may dry out. When they dry out, the voltage drops down and the reference voltage gets lost. Keep in mind, too, the whole power supply is often housed in a metal chassis, which tends to exacerbate the heat problem.

Switch mode supplies are not as simple to troubleshoot as linear supplies. For example, if the capacitor in the feedback loop of a certain type of supply were to dry up, the feedback voltage would be much lower than normal. Then, the power supply would not on, because the feedback voltage would be essentially missing. Most of the time, by checking the components, you can locate the one that has failed.

Very rarely do you have to change the switch mode transformer. If you want to check this transformer, you will need special equipment, that can perform a ringing test, which tells you immediately if the transformer is good. ■

Servicing TVs Today

TV SERVICE MENUS: AN UPDATE

By Bob Rose

I did an article several years ago on working with TV service menus. The article was so well received and used that I have been asked to do an update. I can't say that much has changed in the intervening years except that working with service menus has become a matter of routine. Let me put it differently. If you repair modern generation televisions, you must work with service menus. There are no exceptions. In this update, I will add some information gleaned from the newer products, emphasize information I already gave you, and add some technical information that is useful as you work with service menus.

Numbering Systems

First, let's take a look at some technical information that I have found quite useful as I work with service menus and EEPROM programming. It may be old hat to some. If it is, please stay with me.

I am not a computer programmer or mathematics whiz. I had to learn about numbering systems because I fix TV's, and modern TVs have computers and computer memory in them, which are based on the binary numbering system. I learned about them by reading technical literature and listening to my PhD candidate son tell me about it. He wanted to give me the whole ball of wax, but finally understood that I was interested in the numbering systems used in digital electronics, specifically binary and hexadecimal.

Binary Numbers

Binary numbers are those that are based on the number 2 and are important because of the way computers operate. A microprocessor deals with two just logic states, high versus low or true versus false. The binary system ideally fits those requirements because it uses 1's and 0's to represent the two states. Keep in mind that the binary code is a numbering system in which each allowable position has just two possible states.

A computer works wonderfully with binary numbers, but humans have to struggle to understand them. Binary numbers feel like an alien intrusion in our well-ordered world, an illogical and unnatural way of counting. Our feelings grow out of the fact that we use a numbering system that mathematicians call the decimal system, a system based on the number ten. After all, what is more logical and easier to use than a system of numbers based on the number of fingers we have?

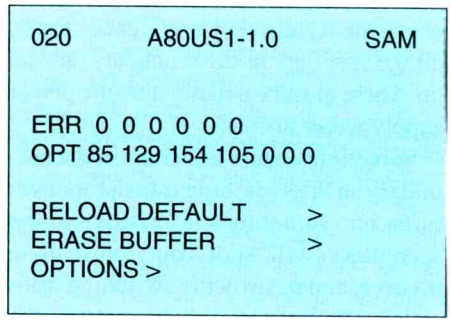

Figure 1.

It seems that all numbering systems follow the same set of rules. The base of a system tells you how many possible numbers can exist in each digit position.

In the decimal, or base-ten system, the single digits are 0 through 9, and any one of them can appear in any position. As you count up from 0 to reach 9 and add a 1 to get 10, you create another digit position to the left of the last digit counted by "carrying" by the1. The result is 9 + 1 = 10.

In the binary system, the single digit numbers are 0 and 1. As you count up from 0 to 1 and add yet another 1, you have to add another digit to the left of the original digit and "carry" a 1 to get 10. This is exactly what you do in decimal, and the results look the same. However, looks are deceiving. The "10" in decimal is really "10" (a ten). But the "10" in binary isn't a 10 (as in ten fingers.) It is a "one-zero" and represents the number "2" in decimal (as in two fingers). Yep. Looks are deceiving.

The following table translates the decimal numbers 0 through 15 into binary code. Note that each decimal number translates into a four bit binary number. In computer jargon, four bits equals a "nibble."

0	0000
1	0001
2	0010
3	0011
4	0100
5	0101
6	0110
7	0111
8	1000
9	1001
10	1010
11	1011
12	1100
13	1101
14	1110
15	1111

At the risk of overkill, I'll give you another example using the decimal number 123. In a number like 123 (one hundred and twenty three), the number in the right hand position (LSB) is worth 1; the value of the number in the next most significant place is ten; and the number in the left hand position (the MSB) is worth 100. The rule goes like this. No matter what base you work in, when you start adding digits to the left each one is worth the base times the digit to the right.

Shall we see how 123 in decimal decodes? The number to the right is worth 1; the value of the next most significant number is worth ten; the value of the number in the most significant position is worth 100. There are three 1's that equal 3. There is a 2 in the next position, making its value 20. There is a 1 in the MSB, making its value 100. The digits add up to 123.

The same principles hold true in the binary system with the exception of the base. The LSB is worth 1; the next most significant digit is worth 2; the next most significant bit is worth 4; and the next one is worth 8. And on and on the string goes. Each bit is worth two times the base of the previous bit. What, then, is an eight bit binary number worth in decimal? Well, an eight bit binary number looks like this: 1111 1111. Beginning at the right and moving to the left, the number decodes as follows: 1 + 2 + 4 + 8 + 16 +32 + 64 + 138 = 265 in base ten.

Hexadecimal Numbers

Computer programmers use a numbering system to represent binary numbers larger than four bits (a nibble). It is called the "hexadecimal" or base sixteen system. The literature usually simply refers to it as "hex." The following table lists the decimal numbers 0-15 and the hex equivalent.

0	0
1	1
2	2
3	3
4	4
5	5
6	6
7	7
8	8
9	9
10	A
11	B
12	C
13	D
14	E
15	F

As you see, hex diverges from decimal once you count beyond 9. The other major difference between decimal and hex is this: hex permits up to sixteen possible unique numerals in each digit position. However, the same rules that apply to binary and decimal apply to hex. Beginning at the right and working to the left, the first digit is worth 1 while the next is worth its value times the base (which is 16).

A couple of examples ought to solidify an understanding of hex.

If you add 1 + 9, you get A. "A" translates into decimal as "10" (ten fingers). Adding 1 to F yields 10 in hex, which is pronounced "one zero." Sounds confusing, but it isn't. Translate hex into decimal like this. Multiply the LSB (the number on the left) by 16 and add the product to the MSB (the number on the right) to get the decimal equivalent. How does 10 (one zero) translate into decimal? Take the 1 and multiply it by 16 and add the product to 0: 1 x 16 + 0 = 16. A "10" in hex equals "16" in decimal.

Here's a final example. Assume that the hex number "1F" pops up when you are working in a service menu and you want to know its decimal equivalent. Following the rule, multiply the 1 by 16 and add the product to F: 1 x 16 + 15 = 31.

Representative Service Menus

As I recall, I've dealt with the service menus of most major manufacturers in past articles. Since I don't want to repeat myself in order to make room for new information, I'll simply ask you to refer to those articles. For example, I wrote a rather lengthy article about a Magnavox PTV that literally gave me a headache. Because I had to manipulate data in the service menu, I gave instructions about how to access the service menu. I will therefore limit my remarks to the really new stuff. However, I will list in abbreviated form the procedure for entering the service menus for some of the older TV's and a few of the newer ones that I haven't had occasion to mention until now.

Philips — Magnavox D-7

The procedure for accessing most Philips' service menus hasn't changed. Use the remote control and press in rapid succession: 0-6-2-5-9-6-MENU (or STATUS). Be certain that you don't permit the display to time out between entries as you key in the sequence.

I'm going to use the D-7 chassis to represent Philips products because it has been out for a few years, giving most servicers an opportunity to become familiar with it. It is also an excellent representative of the new Philips stuff because it has a complicated service menu: (1) SAM or service alignment mode, (2) SDM or service default mode, and (3) CSM or customer service mode. Since the D-7 is like the new generation Philips products, the information I'm about to give you applies to Philips latest products like the G-7. There is, though, one exception if I am not mistaken; the newer

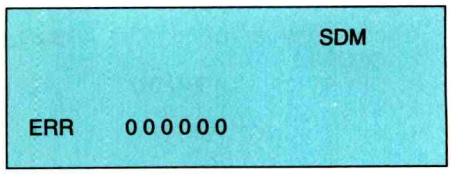

Figure 2.

Philips products have for the most part eliminated the service default mode.

Service Alignment Mode

When you enter the service mode (0-6-2-5-9-6- STATUS), the letters "SAM" pop up on the display, telling you that you have accessed the "service alignment mode." This is the "top level" menu and permits you to make certain adjustments, write defaults into the memory IC, and erase error codes. It also displays the Life Timer, the software version, and the current options settings. If you press the MENU button while in the SAM, the software switches to what Philips calls "a virtual customer mode," permitting you to make adjustments to all of the customer menu features. If you press MENU on the remote again, the software reverts to the "top level" menu.

The top-level menu is the first menu that you work with when you access the SAM (Figure 1). Make a note that the values are given in hex format!

The first set of characters, 020F, is the run timer display and tells you how many hours the TV has been in use. You might be interested to know that it advances one hour each time the set is turned on. The second set of characters (A80US1-1.0) identifies the software version, the country, the version, and the cluster. Of course "SAM" in the upper right hand corner indicates that the TV is in the service alignment mode.

The second line lists the six most recent

Error Code Table

0	=	No error
1	=	X-ray protection, E/W protection, and/or Vertical protection active
2	=	High beam current protection active
3	=	Reserved
4	=	+5V protection active
5	=	Signal Processor (IC 7150) register corrupted
6	=	Signal Processor (IC 7150) error
7	=	Total failure
8	=	Internal RAM error (Microprocessor IC 7000)
10	=	NV memory (IC7088) addressing error
11	=	NV memory (IC7088) size error
12	=	Histogram (YUV) (IC7770) error
14	=	Sound processor I²C error (TDA9855)
16	=	Main Tuner I²C error (IC 7350)
17	=	PIP Processor I²C error (IC 7350)
18	=	PIP Tuner I²C error

Note: I²C = (SCL/SDA)

Table 1.

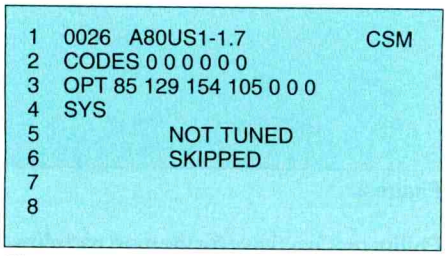

Figure 3.

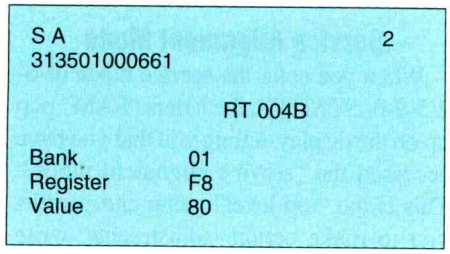

Figure 3A.

error codes, the most recent error code immediately follows the "ERR." Table 1 lists the error codes. You may erase the error codes by exiting the SAM using the power button on the remote control. If you want to save them, remove ac power before you exit the SAM. When you reapply ac, the chassis will come on in the SAM.

The next line in the display (OPT) shows the feature byte values for the model you are servicing (Table 2). Terminology gets confusing because it really hasn't been standardized. Think, then, of a "feature bit" as an "option."

The bottom three lines in the display represent the SAM sub-menus and require a bit more discussion. Keep Table 2 handy as the discussion progresses. By the way, access the sub-menus by pressing the left/right cursor keys on the remote, and toggle among them by using the up/down cursor keys.

SAM MENU		SUB-MENU		
RELOAD DEFAULT	>	LOAD NOW/ DO NOT LOAD		
OPTIONS	>	PT/RL/SA/SC/SO/PL/PI/IP/HO/GP/FT/FM/EX/DN/ AK/AD/AB/STORE/SP/SR/SS/ST/SV/WS/CF/IM/VS/TM/OB1/OB2/OB3/ OB4/OB5/OB6/OB7		
ALIGNMENTS	>	BTSC SND	>	WA
				AA (Do not use)
				LA
				SA
		TUNER	>	IF-PLL/AGC (IF-PLL is automatic, AGC is adjustable)
				AFA (Not adjustable)
				AFB (Not adjustable)
		WHITE TONE	>	COOL
				NORMAL
				WARM
				(Toggle R, G, & B value up/down to adjust)
		GEOMETRY	>	VER S-COR
				VERZOOM
				HORSHIFT
				HORWIDTH
				SERV. BLANK (ON/OFF)
				VERSHIFT
				VERHEIGHT
				VERSLOPE
				EW PARABO
				EW TRAPEZ
				EW CORNER

Table 2.

D7 CHASSIS FEATURE BITS

Antenna A/B	A/B	PIP Tuner	PT
Audio Control	AD	Remote Locator	RL
Auto Standby	AK	Smart Sound AVL	SA
Auto Volume Limiter	AL	Smart Clock	SC
Auto Standby / No Picture	AN	Number of A/Vs	SO
Multiple A/V Inputs	AV	Speaker On/Off	SP
Compress 16x9	CM	Incredible Surround	SR
Customer Service Mode	CS	Smart Sound	SS
Dynamic Noise Reduction	DN	Auto Standby / Auto On	ST
Expand 14x9	EX	First Time Setup	SU
Mono / Stereo A/V	FM	Wide Screen	WS
Fine Tuning	FT	Comb Filter	CF
Hospitality Mode	HO	Incredible Picture via Menu	IM
Incredible Picture	IP	Sync Slice Limiter	VS
PIP Control	PI	Timer	TM
Parental lock	PL		

Table 3.

Reload Default.

Access "Reload Default" only when the memory chip (7088) has been replaced. In such an event, you must start here and perform all alignments and adjustments! If you want to reload defaults, begin by pressing the cursor up/down keys on the remote to highlight "Reload Default." Use the cursor right key to view the "Load Now" and "Do Not Load" options. If you reload the default values, use the cursor up/down keys to highlight "Load Now" and press the cursor right key. The "Load Now" changes to "Loading" while the defaults are loading. "Load Now" reappears when the default values have been loaded.

If you elect to save changes, use the "Save Procedure" that I will discuss in a few paragraphs.

Erase Buffer

This sub-menu permits you to erase the error buffer. Select "Erase Buffer" by using the cursor up/down keys, and press the cursor right key. The display resets to zeroes.

Options

This feature permits you to change the chassis feature bits listed in Table 3. The literature says that this menu also allows the servicer to change the feature bytes, which are 0B1, 0B2, 0B3, and 0B4. 0B5, 0B6, and 0B7 are always set to 0. Feature bytes also change when the feature bit changes. Take a look at Table 4 to see a technical representation of "feature byte" and "feature bit." To change a feature byte, use a three-digit entry on the remote control. If the entry you want to make has a

D7 CHASSIS TEATURE BITS

Final Instrument	Chassis Assem	Transmiter	AB	AD	AK	AL	AN	AV	CM	CS	DN	EX	FM	FT	GP	HO	IP	PI
	EEPROM ADDSRESS		3 b7	3 b6	3 b5	3 b4	3 b3	3 b2	3 b1	3 b0	4 b7	4 b6	4 b5	4 b4	4 b3	4 b2	4 b1	PI
TP2781C1	EMD770	RCU81B	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	PI
MX2791B1	EMD772	RCU81E	1	1	0	1	0	1	0	1	1	0	0	0	0	0	1	PI
29LP6822	EMD771	RCU81AX	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	1
29LP6832	EMD773	RCU81AX	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	1
TS3258C1	EMD780	RCU81BX	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	0
TP3281C1	EMD782	RCU81B	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1
MX3291B1	EMD784	RCU81E	1	1	0	1	0	1	0	1	1	0	0	0	0	0	1	1
33LP8832	EMD781	RCU81AX	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	1
TS3658C1	EMD790	RCU81BX	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	0
TP3681C1	EMD792	RCU81B	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	1
MX3691B1	EMD794	RCU81E	1	1	0	1	0	1	0	1	1	0	0	0	0	0	1	1
37LP9822	EMD791	RCU81AX	1	1	0	1	0	1	0	1	1	0	0	1	0	1	1	1

Final Instrument	Chassis Assem	Transmitter	PL	PT	RL	SA	SC	SO	SP	SR	SS	ST	SU	WS	CF	IM	VS	TM
	EEPROM ADDSRESS		5 b7	5 b6	5 b5	5 b4	5 b3	5 b2	5 b1	5 b0	6 b7	6 b6	6 b5	6 b4	6 b3	6 b2	6 b1	6 b0
TP2781C1	EMD770	RCU81B	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1
MX2791B1	EMD772	RCU81E	1	1	1	1	1	0	1	0	0	1	1	0	1	1	0	1
29LP6822	EMD771	RCU81AX	1	1	0	0	0	0	1	1	1	1	0	0	1	1	0	1
29LP6832	EMD773	RCU81AX	1	1	0	0	0	0	1	1	1	1	0	0	1	1	0	1
TS3258C1	EMD780	RCU81BX	1	0	0	1	1	0	1	0	0	1	1	0	0	1	0	1
TP3281C1	EMD782	RCU81B	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1
MX3291B1	EMD784	RCU81E	1	1	1	1	1	0	1	0	0	1	1	0	1	1	0	1
33LP8832	EMD781	RCU81AX	1	1	0	0	0	0	1	1	1	1	0	0	1	1	0	1
TS3658C1	EMD790	RCU81BX	1	1	0	1	1	0	1	0	0	1	1	0	1	1	0	1
TP6381C1	EMD792	RCU81B	1	0	0	1	1	0	1	0	0	1	1	0	1	1	0	1
MX3691B1	EMD794	RCU81E	1	1	1	1	1	0	1	0	0	1	1	0	1	1	0	1
37LP9822	EMD791	RCU81AX	1	1	0	0	0	0	1	1	1	1	0	0	1	1	0	1

Table 4.

two-digit value, precede the two digits with a 0. Remember that when you change a feature byte you also change the feature bit.

I assume you want to store the changes you have made in the SAM. Use the cursor up/down keys to highlight "Store." Press the cursor right key, and "Store" will change briefly to "Stored." When it changes to "Stored," press the menu button to return to the top level SAM menu. You must perform this step to store the changes you have made.

The "Alignments" Sub-Memu.

I won't go into detail about these parameters because their designations tell you what they control (Table 2). Be advised that you will most certainly need the service manual in the unlikely event that you have to do a complete chassis alignment. However, the time may come when you need to touch up an adjustment or two. When such a time comes, use the remote control keys as I have described them to make the necessary adjustments. Because these adjustments are critical to the operation of the TV, I suggest that you go into the menu of the next D-7 chassis you service and copy the parameters that are there. Those values may not be precisely what you need in the event of a catastrophic failure of the EEPROM, but they ought to get you into the ballpark.

Do three things to save whatever changes you have written to the EEPROM after you have finished making adjustments in the alignment sub-menu: (1) press MENU to return to the top level SAM menu; (2) press power to turn the set off; and (3) disconnect the set from ac for at least ten seconds.

SERVICES PAGES

The second letter indicates which Service Page the set is currently in.

A = Setting Feature Word and other adjustments (See Chassis Feature Chart on Page 6)
B = AFC Alignment (IF-PLL)
C = AGC Alignment
D = Stereo Input Level*
E = Wideband/Spectral Stereo Adjustment*
F = DO NOT USE -SPECIAL FACTORY STEREO SETUP
G = White Balance (White Point)
H = Horizontal Center & Vertical Geometry
I = Exit Service Mode

*If available

The available Service Pages can be accessed by pressing the Menu button on the remote transmitter to scroll from page A to page I or accessed directly by entering the corresponding number key on the Remote Transmitter.

Table 4A.

Parameters

There are a limited set of instrument parameters available to the technician from the front panel of the set. All other alignments or adjustments are accessible via Chipper CheckTM troubleshooting software and PC.

P:	Parameter Name	Value Range	Notes and Comments
00	Security Parameter	76	Cannot advance to parameters until value is met
01	Error Detection (1st)	???	First Error Code
02	Error Detection (2nd)	???	Second Error Code
03	Error Detection (3rd)	???	Third Error Code
04	Horiz. Phase	00..15	
05	EW DC (Width)	00..31	
06	EW Amplitude00..15		
07	EW Tilt	00..15	
08	Top Corner Correction	00..07	
09	Bottom Corner Correction	00..07	
10	Vertical D.C.	00..63	
11	Vertical Size	00..127	
12	Vertical Countdown Mode	00..03	0= Standard; 1= Non-Standard; 2= 50 Hz; 3= 48 Hz
13	Red Bias	00..127	See "Service Line"
14	Green Bias	00..127	See "Service Line"
15	Blue Bias	00..127	See "Service Line"
16	Red Drive	00..63	
17	Green Drive	00..63	
18	Blue Drive	00..63	
19	Gemstar H OSD Position	00..255	For Gemstar only
20	Gemstar V OSD Position	00..255	For Gemstar only
21	Gemstar H PIP Position	00..255	For Gemstar only
22	Gemstar V PIP Position	00..255	For Gemstar only
23	Gemstar PIP Window Vertical Size	00..13	For Gemstar onl

Table 5.

Error Code: HEX	Error Code: DEC	Chassis:	Error:
		POWER CONTROL ERRORS	
00	0	ALL	No ERRORS
01	1	ALL	16V_STBY fault
03	3	ALL	12V_RUN fault
08	8	ALL	T4-Chip XRP (X-ray protection)
09	9	ALL	T4-Chip POR (power on reset)
0A	10	w/F2 PIP	F2PIP POR
0B	11	ALL	Stereo Decoder POR
10	16	ALL	Run IIC bus latched
12	18	ALL	Standby IIC bus latched
		IIC ACKNOWLEDGE ERRORS	
22	34	w/Gemstar	Gemstar bus fault
2C	44	w/F2PIP	F2PIP fault
80	128	ALL	Stereo Decoder fault
BA	186	ALL	T4chip fault
C4	196	ALL	Main Tuner PLL bus fault
C6	198	ALL	Main Tuner DAC bus fault

Table 6.

Service Default Mode

The literature says that the SDM should be used for taking voltage and waveform readings or for checking error codes. Access it by pressing the sequence 0-6-2-5-9-6-MENU on the remote control. When it enters the SDM, the TV display will look like the one depicted in Figure 2. This display displaces all normal on-screen displays.

If you press the STATUS button, the display shows the current error codes. Pressing the STATUS button again hides them. If you press MENU on the remote, the software switches to a "virtual customer mode," permitting you to make adjustments to the customer menu. Pressing MENU again, causes the software to revert to the "top level" menu.

To exit the SDM and erase the error codes, turn the unit off with the power button on the remote control, unplug the ac cord for about ten seconds, and reapply ac. Breaking the ac connection ensures that the microprocessor downloads the new settings from the EEPROM when power is reapplied. If you want to save the error codes, unplug the ac cord while the TV is still on. When you reapply ac, the TV will come back on in the SDM mode.

I don't want to sound presumptuous or be judgmental, but I can't see the reason for the SDM. It seems to be a software program that more or less clutters up the field.

If you have information that I don't have about the SDM, please share it with me because I'd really like to know why the engineers included a SDM mode.

Customer Service Mode

The CSM is used to retrieve data on the TV's operational settings and the stored error codes. Press and hold for at least four seconds MUTE and CHANNEL UP on remote at the same time. The CSM display comes up and looks like the one depicted in Figure 3.

Philips says the servicer can instruct the customer by telephone to enter the CSM and convey the on-screen information and use it to gain insights into possible failures before traveling to the customer's home. This might work if the problem is an "operation problem" like having engaged Smart Lock or Closed Captions.

You might like to know that when it is in the CSM, the TV turns off all "disruptive" functions and won't permit the customer to make any changes to its settings or functions. The TV reverts to its prior operational state on exiting the CSM, which is accomplished by pressing the power button on the remote or the front of the TV.

The idea behind the CSM seems to be good. How it has worked in the field-well that's another matter. I think it has become like a lot of features the new TV's have; it just goes unused.

Philips-Magnavox B7/B8

Here's another Magnavox product that ought to interest you. I include it because its EEPROM (IC302) has a tendency to fail. The failure shows up in one or more ways: (1) an on screen display that is off center, (2) inability to retain customer settings in memory, (3) no audio, and (4) no audio-no video while the CRT displays a "slick raster." Some models operate just fine without the EEPROM while others need the EEPROM in circuit.

Enter the service menu by entering on the remote control 0-6-2-5-9-6-MENU. The screen should show a display similar the one pictured in Figure 3A. The letter "S" at the top indicates

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- Solve problems, review markets, set goals
- Network with colleagues and competitors
- Meet the press at the key event for the channel media
- Get new ideas and new insight, in workshops, meetings, and casual conversation

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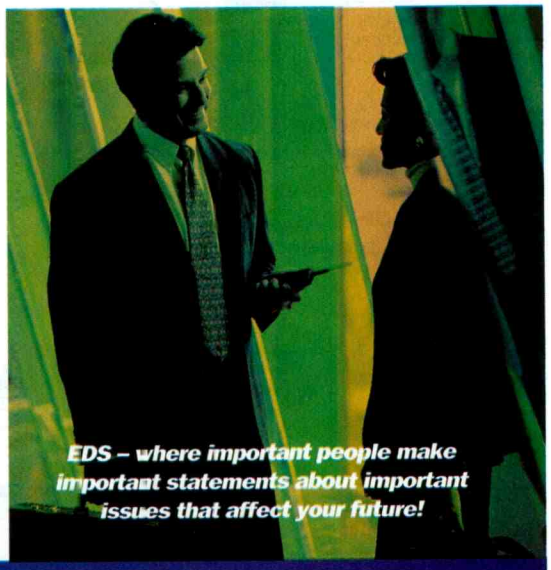

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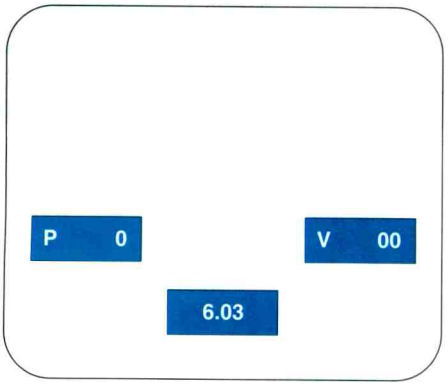


Figure 4.

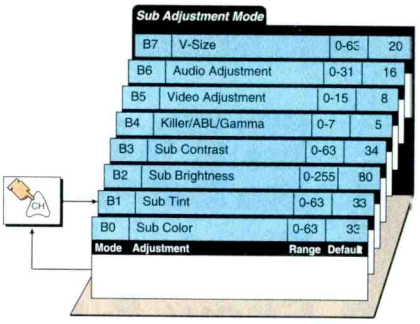


Table 7.

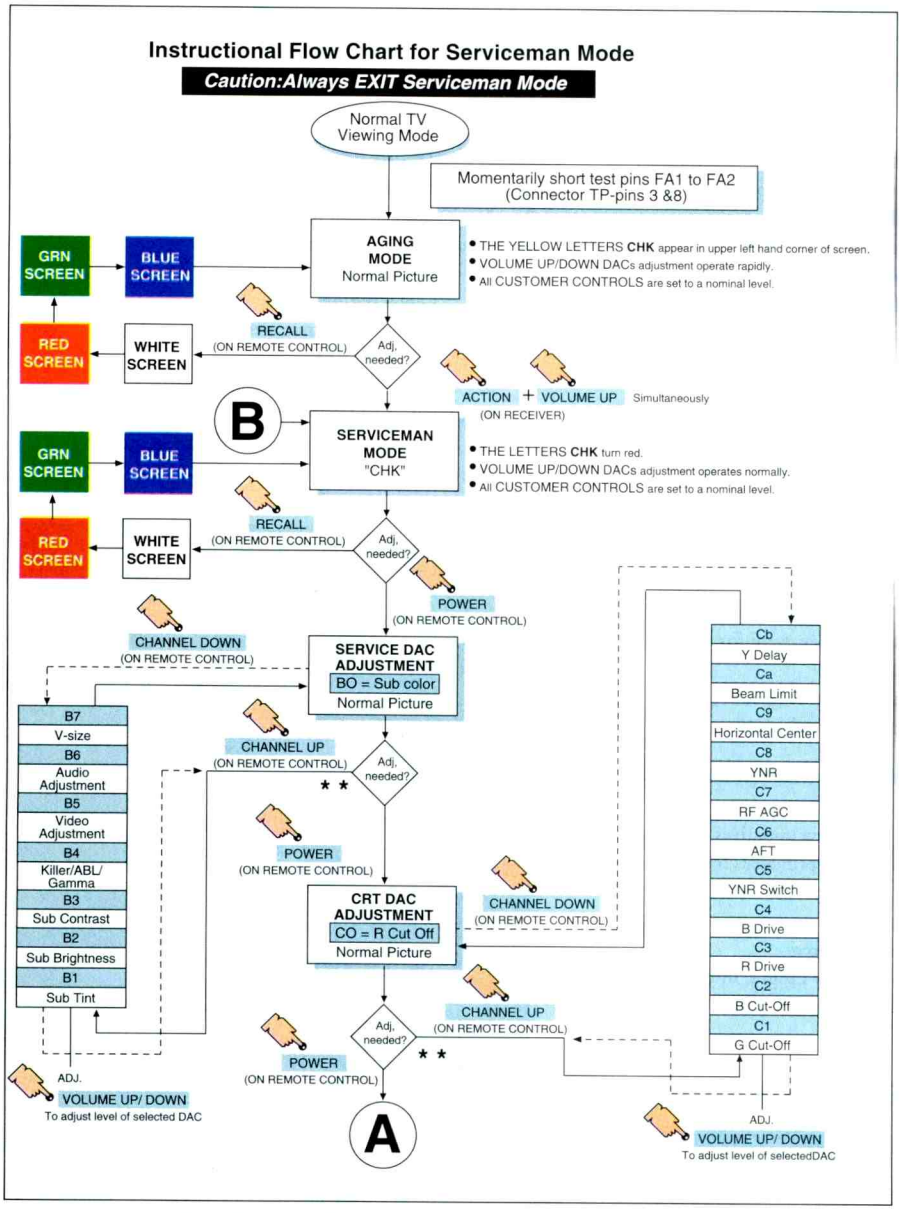


Figure 5 (Part 1). Flow Chart for Serviceman Mode.

the service mode. The second letter, "A" indicates the service page to which the service menu is open. Table 4A is a list of the available pages.

Access the service menu pages by pressing MENU on the remote control from page A through page I or by pressing the corresponding key on the remote control where 1 = A, 2=B, 3=C, and so on through 9=I. However, do not use the number 6 key (which equals page F).

Access the register in question and change its value in the usual way. Note that the values of the registers are stored in hex format.

Exit the service mode by entering Page I (key 9 on the remote control) and pressing the VOLUME UP button on the remote.

Thomson Multimedia (RCA)

The CTC203 is the latest Thomson offering to consumers. On this product, enter the service mode by turning the TV on. Then press and hold the MENU button while pressing and releasing the POWER button followed by pressing and releasing the VOLUME UP button. The TV enters the service mode and displays a one-line menu like the one shown in Figure 4.

When the service mode first comes up, the parameter (P) will be 0. The "0" is used for security purposes to keep unauthorized people from tinkering with the data. To gain access to the service menu, set the value (V) to 76 by using the VOLUME UP - VOLUME DOWN buttons. Select the parameters by using CHANNEL UP - CHANNEL DOWN buttons. As you see, there is nothing new about this.

The new features about the CTC203's service menu are two-fold. First, there are a limited set of instrument parameters available for adjustment via the front panel controls or the remote control. Those are listed in Table 5 (The penciled-in values were taken from a good, working set.). Second, the servicer must access all other alignments and/or adjustments by using ChipperCheck(tm) and a PC.

By the way, make a note that the first three parameters (01, 02, 03) store the error codes (Table 6).

As you see, the CTC203 has a mix of something old as well as something new.

Toshiba

Use this procedure to access the service menu:

Turn the TV on.

Press MUTE on the remote control.

Press MUTE again and hold it while pressing MENU on TV.

The letter "S" should appear on the screen indicating the TV is in service mode.

Once in the service mode, select the adjustment that you want to change by using theCHANNEL UP -CHANNEL DOWN buttons, and make the change by using VOLUME UP-VOLUME DOWN buttons.

Sony

On Sony products, to enter the service mode, turn the TV off. Then quickly press DISPLAY 5, VOLUME +, and POWER. The word "service" should pop onto the screen. Press 1 or 4 to select an item that you want to adjust and 3 or 6 to adjust it. Finally, press MUTE followed by ENTER to set each adjustment.

Zenith

The procedure for gaining access to Zenith's service menus hasn't changed in several years. Begin by pressing and holding the MENU button until the menu comes up and then disappears. Then press in rapid succession 9-8-7-6-ENTER. The service menu pops up usually at number three in the service menu and gives you limited access to the full menu. To access the entire menu, select "Factory Mode" (parameter 00) and turn it on. After you make the adjustments you want to make, return to Factory Mode and turn it off. Exit the service menu by pressing ENTER.

Some of the older Zeniths require a different procedure for accessing the service menu, for example the C6, C8, C10, and C11 chassis. Using the controls on the front of the TV, press and hold MENU until the menu comes up and disappears. Then without delay press simultaneously ADJUST RIGHT and CHANNEL UP.

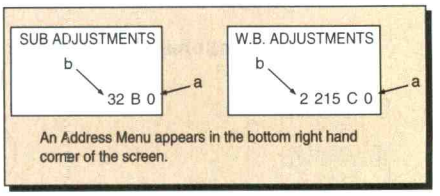


Figure 6.

Panasonic

Accessing service data for Panasonic/Quasar varies a little from chassis to chassis. The information I'm about to give you concerns the CT32S21V (NA6D manual, AMPED282 chassis). While others use service menu or very similar terminology, the engineers at Panasonic opt to call it "serviceman

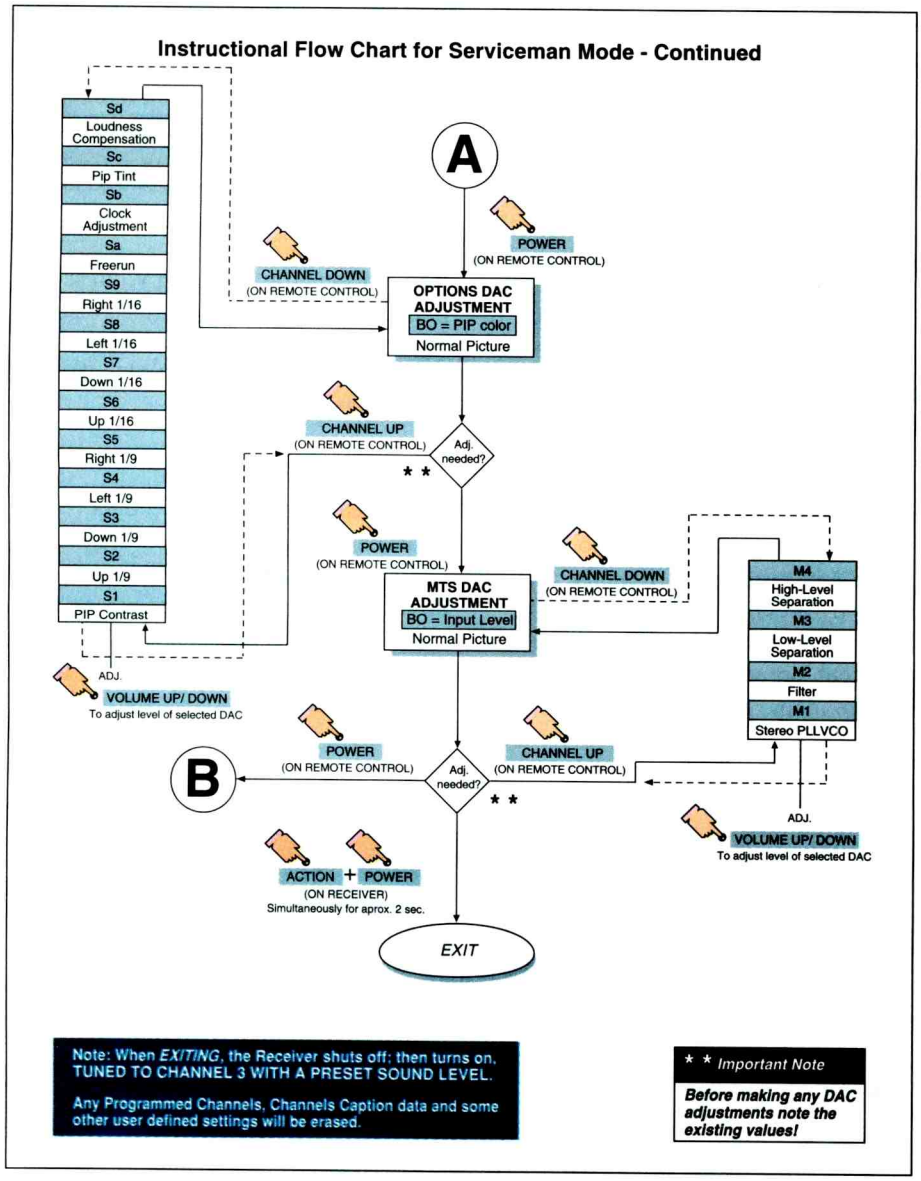


Figure 5 (Part 2). Flow Chart for Serviceman Mode.

mode." Instead of giving the information in narrative form, I thought it best to copy the flow chart as it appears in the NA6D manual (Figure 5).

Here's a quick summary of the information contained in Figure 5.

While the TV is on and operating in the normal mode, momentarily short FA1 to FA2 (which is cold ground). The test points are located on the A-Board at TP pins 8 and 3. The receiver enters the "Aging Mode" as the yellow letters "CHK" on the screen indicates. Simultaneously press the ACTION and VOLUME UP buttons on the TV. The TV enters the SMM (serviceman mode). Note that "CHK" turns from yellow to red.

Connecting test pins FA1 and FA2 involves taking the back off the TV. However, there is what Panasonic calls a "quick entry" to the SMM that gives you limited access to the data. Using the remote control, do the following:

select the SET-UP icon and select CABLE mode;

select the TIMER icon and set the SLEEP timer for 30 minutes;

press the ACTION button twice to exit MENUS;

tune to channel 124;

adjust VOLUME to minimum.

and on the receiver press the VOLUME DOWN button.

A red "CHK" should appear in the upper corner of the screen.

You aren't through yet because you have to toggle between the "aging mode" and the SSM. Here's how to do it. While the "CHK" is on the screen, press the ACTION and VOLUME DOWN buttons the TV at the same time. You are now where you want to be, and the screen should resemble the one pictured in Figure 6.

Now press the POWER button on the remote control to select one of five serviceman adjustment modes:

(1) B = serviceman VCJ sub-adjustments (table seven),

(2) C = serviceman VCJ cut-off adjustments (table eight),

(3) S = serviceman options (PIP and CLOCK) adjustments,

(4) M = serviceman MTS adjustments (table nine), and

(5) "CHK" = normal operation of channel up/down and volume up/down.

Having selected an adjustment mode, use the CHANNEL UP - CHANNEL DOWN buttons to highlight the adjustment you want to make and the VOLUME UP - VOLUME DOWN buttons to make the adjustment.

Now, be absolutely certain to exit the SMM after completing the adjustments by pressing the ACTION and POWER buttons on the TV at the same time and holding them for at least two seconds. The TV should momentarily shut off and come back on to channel 3 with a preset level of sound.

Finally a word of warning. Before you plunge headlong into major alignments like the video or MTS circuit, I urge you to get a service manual and have the appropriate equipment handy.

Conclusion

I thought about including a few other models in my discussion, but time and space caught up with me. Given those limitations, I considered my work and what I need to know in order to do my work responsibly and efficiently and acted accordingly. I hope you find the information useful. As usual, I'm open to suggestions. ■

Enjoying Five Discrete Audio Channels on a Stereo Headset

by Alvin G. Sydnor

What do you do if you live in an apartment or have family members who don't want to experience a film or watch a film on an airline or a portable DVD player? Up until about a year ago the answer was to listen to the movie/program through a standard stereo headset and enjoy a stereo version of a multi-channel program and lose the rich surround sound. With today's advances in electronic technology you can listen through the same set of stereo headphones, and experience the 360-degree sound stage simulated by virtual multiple audio channels.

Thomas Edison's great invention of the phonograph in 1877 started what many called the "Golden Age of Audio" and many entrepreneurs began to improve on the invention. It may come as a complete surprise to many that 103 years ago in 1898 the Columbia Phonograph Company introduced their "Multiplex Graphophone Grand", that played back three separate sound tracks simultaneously. Note that the term "multiplex" was being used instead of "stereo" and today we relate multiplex as a method of FM audio hi-fidelity reproduction.

It is interesting to visualize a group of instrumentalists or singers clustered in front of three horns that would produce three sound tracks. The spacing and lengths of the directional horns would seem to indicate that a stereophonic playback could be reproduced. Unfortunately this development was not recognized as "stereo."

Today consumers are demanding more interactivity, functionality and user-friendly systems. We are now at the point where the home theater surround systems with five discrete audio channels are part of the mainstream audio/video solution for the home.

Believe it or not, in the late 1940's there were many that had serious doubts as to the validity of stereophonic reproduction of sound in the home. The problem stems from the nature of the evolution of stereo from its predecessor, binaural sound. I remember years ago when it was a rewarding experience to achieve spatial realism listening to monophonic reproduction with dual-headphones.

By 1985 the popularity of stereo and the use of headsets had reached its peak with more than 30 different manufacturers offering 190 different models. When home theater surround systems with five discrete audio channels was first announced, I began to wonder how one would be able to enjoy the true surround sound using a stereo headset.

What do you do if you live in an apartment or have family members who don't want to experience a film or watch a film on an airline or a portable DVD player? Up until about a year ago the answer was to listen to the movie/program through a standard stereo headset and enjoy a stereo version of a multi-channel program and lose the rich surround sound. With today's advances in electronic technology you can listen through the same set of stereo headphones, and experience the 360-degree sound stage simulated by virtual multiple audio channels.

In 1946 J.K Hilliard expressed the opinion in the april IRE Reviewthat it was generally agreed that any satisfactory form of stereophonic reproduction was very much preferable to single channel audio. During this time many believed that stereophonic reproduction in the strict sense could only be applied in large concert halls or theaters where the audience was situated farther from the loudspeakers than the distance between any two loudspeakers. Fifty-five years later technological advances have provided us this luxury in our home rather than the concert hall or theater.

Headphone listening is not a natural phenomenon. There are two shortcomings when using stereo headsets on surround systems: (1) inside-the-head phantom images and (2) recreating a natural 360-degree sound stage. Unlike the real world where a natural sound is heard by both ears, with headphones each channel is heard only by one ear. The brain interprets this unnatural condition psychoacoustically as though the sound originates inside the head. The phenomenon is taken a step further in the case of surround sound formats.

It is obvious that there is a problem when using headphones while listening to multi-channel audio. The question is how can the original sound track multichannel digital surround sound be presented over only two channels of a headphone while still remaining faithful to the original content. Often, the solution has been to "down-mix" the multiple channels of the original audio down to two channels, that is, Left Down-mix and Right Down-mix using some sort of matrixing technique. Unfortunately, the 360-degree spatialization that was contained in the program is completely lost in that process.

Lake Technology of Australia developed a proprietary solution that is licensed by Dolby Laboratories under the name "Dolby Headphone" that can be enjoyed using any standard stereo headset. The first stand-alone solution was developed on the Motorola Digital Signal Processor (DSP) platform. From a technical standpoint, this is a solution whose time has come and psychoacoustics is an area that is being continually researched and better understood each day.

Since most people who listen through headphones perceive audio images as being inside their head the Dolby Headphone system simulates virtual speakers that are located outside the head. The patented signal-processing algorithm allows the complex acoustical environment of real rooms and the subtle effects of the human ear to be recreated in a convincing manner.

The human head acoustically influ-

ences human hearing as the sound arrives from different directions. Sounds from the left arrive at the right ear later than the left, the level is lower, and it is filtered by the shadowing effect of the head. These effects are called Head Related Transfer Functions (HRTF's) which can be measured. It turns out that these subtle differences in time; level and spectral content are all the brain uses to determine the source of the sound.

By combining the HRTF's and the ability to position sound sources outside the head, one can give the listener the impression that they are listening to sound from a virtual speaker that is positioned anywhere around them. By positioning five or more such virtual speakers around the listener, an entire surround sound system can be replicated over stereo headphones

The Dolby Headphone technology is a complex signal-processing algorithm with a heavy emphasis on frequency-domain technique such as Fast Fourier Transforms. Therefore, the technology works by creating an acoustic illusion and listeners believe they are hearing sound through multiple speakers that are located a few feet away when, in fact, they are wearing ordinary stereo headphones.

What is really fascinating about the Dolby Headphone is that the process can be either encoded in the program material itself prior to distribution or it can be embedded into DSP chips for real-time applications.

Typical applications of surround sound systems are consumer equipment like home theater systems, personal computers and especially portable equipment where headphones are used exclusively. Also, there is an increased market demand for multi-channel audio, and requirements for personal listening systems, and the DSP has made computation-intensive solutions feasible for such applications.

The Dolby Headset technology was born in late 1999 through a licensing agreement between Lake Technology and Dolby Laboratories. Motorola's DSP's provides a comprehensive audio-specific silicon and software solution on a single chip (DSP563X) family.

A unique software architecture has been developed specifically for the audio environment, offering the ability to decode a variety of encoded multi-channel bit streams, while still leaving enough processing power to perform additional post-processing functions such as equalization, sound field processing and HRTF's. The roadmap calls for integration of the Dolby Headphone technology within this software architecture for a very powerful and functionally rich decoding platform.

The technology has been licensed by Singapore Airlines for use in their passenger headsets. In a separate development, an e-commerce imaging and digital system developer MGI Software Corporation of Toronto plans to incorporate the technology into DVD-based multimedia recording and playback devices. ■

Consumer Electronics Profile

HITACHI

Hitachi America, LTD
Home Electronics Division
National Service Division
1855 Dornoch Court
San Diego, CA 92154
Tel: (800) 981-2588
Fax: (619) 661-3991

This is the first in a series of vendor profiles *Electronic Servicing & Technology* magazine will provide the professional servicers communities. It is designed to provide servicers with a word picture of the manufacturers service organization, policies and contacts. If you have a manufacturer you would like profiled, just let us know.

Key to the Hitachi line of Home Electronics is the larger screen television. In addition, Hitachi produces and/or markets a wide variety of electronics products including DVD Cameras, VCRs, and LCD projectors. The National Service Division provides assistance on most Hitachi Products and is most cooperative in assisting servicers on Hitachi products that may be under another jurisdiction.

Within the Service Group, under Walt Herrin is:

- Customer Service
- Technical Services
- Warranty Claims
- Field Service
- Parts
- Parts Distributors

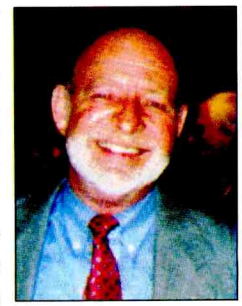
Long an advocate for the proper use, training, pay and evaluation of the independent service professional, Walt Herrin has established an organization that provides schematics and other technical aids to all qualified independent servicers.

Hitachi offers the same level of support to non-authorized servicers that it offers to their authorized network. This includes the same access to their servicer web site, technical service, access to customer service and management.

The one area not controlled is with parts distributors where pricing may vary based on whether a servicer is authorized or not. Overall, according to Hitachi, the only real difference between an authorized servicer and a non-authorized servicer is the ability to file a warranty claim and to get referrals from 800-HITACHI.

Hitachi maintains a limited number of Hitachi Authorized Servicers who receive almost all of the Hitachi Warranty work. Servicers interested in working with Hitachi towards appointment as an authorized servicer should contact their local field rep or Bill Warren at San Diego.

Hitachi stresses its commitment to pay realistic servicer rates based on the cost of doing business within the area the servicer operates and provided the servicer performs in a manner that reflects positively on the Hitachi organization.



Director, National Service: Walt Herrin

The San Diego facility includes a full staff which provides telephone assistance, data sheets, product notices, warranty information and continuous updating of its web site devoted to assisting the professional servicer: www.hitachiserviceusa.com.

This staff also services Hitachi's network of replacement parts distributors.

While most inquiries and assistance can be accessed through the Hitachi servicer web www.hitachiserviceusa.com, following is a list of key departments and individuals that may be of assistance for those situations not covered or resolved via the web.

Customer Service

Tel: (800) 448-2244 (800 HITACHI), PROMPT 1, 4 (8am-8pm CT)
Fax: (309) 679-4471
Email:
Customerservice.ce@hhea.hitachi.com

Manager: Teresa Omar
Tel: (800) 981-2588. Ext. 3748 (8am-5pm PT)
Fax: (619) 661-3992
Email: Teresa.omar@hhea.hitchi.com

Technical Services

Web Site: www.hitachiserviceusa.com
Tel: (619) 661-1043
Fax: (619) 661-5496
Email: techsupport@hhea.hitachi.com

Manager: James Kulwicki
Tel: (800) 981-2588, ext.3755 (7am-4pm PT)
Fax: (619) 661-5496
Email: james.kulwicki@hhea.hitachi.com

Field Service

Web Site: www.hitachiserviceusa.com
Field Service Information
1. "How Do I" Policies and Procedures Guide
2. Product Warranty Periods

Sr. Manager, Field/Warranty Operations:
Bill Warren
Tel: (800) 981-2588, Ext. 3791 (8am-5pm PT)
Fax: (619) 661-3991
Email: bill.warren@hhea.hitachi.com

Field Service Representative:
Glen Darling
Tel: (800) 241-6558, Ext. 5109 (7am-4pm ET)
Fax: (208) 988-1536
Email: glen_darling@yahoo.com

Parts Department

Tel: (800) 369-0422 (7:30am-4pm PT)
Fax: (800) 685-7787

Senior Manager–National Parts:
Robert Davis
Tel: (800) 981-2588, Ext. 3747 (8am-4pm PT)
Fax: (800) 685-7787
Email: robert.davis@hhea.hitachi.com

Servicer Web Site:
www.hitachiserviceusa.com

Warranty Claims

Inquires on Status, Rejection Corrections, Claim Filing Assistance:
Satisfusion (WTI/Wood Technologies)
Tel: (562) 988-1190 (9am-4pm PT)
Email available through web site:
www.woodtek.com

For issues that require Hitachi authorization:
Sr. Manager, Field/Warranty Operations:
Bill Warren
Tel: (800) 981-2588, Ext. 3791 (8am-5pm PT)
Fax: (619) 661-3991
Email: bill.warren@hhea.hitachi.com

Warranty Claims Administrator:
Manny Mercado
Tel: (800) 981-2588, Ext. 3759 (7am-4pm PT)
Fax: (619) 661-3991
Email: warrenty@hhea.hitachi.com

Industry Participation

The Hitachi National Service Division is active in many industry organizations including NESDA, ETA-I, NARDA, PSA and PsoC.

The division participates in local and national conferences, training seminars and industry conventions throughout the year including NPSC. Walt Herrin is known for his exceptional speaking style and ability to communicate the servicers interests.

Distribution Network

Servicers are encouraged to contact the following Hitachi Authorized Parts Distributors for their service needs.

Andrews Electronics
www.andrewselectronics.com
25158 Avenue Stanford
Santa Clarita, CA 91355
Tel: (800) 289-0300
Fax: (800) 289-0301

Martin Distributing/Audio Video Parts Inc.
www.mdcla.com
1071 South LaBrea Avenue
Los Angeles, CA 90019
Tel: (323) 857-1900 / (800) 660-8771
Fax: (323) 857-0999 / (800) 762-5729

Fox International Ltd. Inc.
www.fox-international.com
23600 Aurora Road
Bedford Heights (Cleveland), OH 44146
Tel: (800) 321-6993
Fax: (800) 445-7991

Herman/Panson Electronics
www.hermanpanson.com
7350 NW 35th Terrace
Miami, FL 33122
Tel: (800) 938-4376
Fax: (800) 938-4377

Pacific Coast Parts Distributors Inc.
www.pacparts.com
2114 SE 9th Avenue
Portland, OR 97214
Tel: (800) 338-6342
Fax: (800) 962-0602

Tritronics Inc.
www.tritronicsinc.com
1306 Continental Drive
Abingdon, MD 21009
Tel: (410) 676-7300 / (800) 638-3328
Fax: (800) 888-3293

Union Electronic Distributors
www.ued.net
311 East Corning Road
Beecher (Chicago), IL 60401
Tel: (800) 648-6657
Fax: (800) 438-6466

Vance Baldwin Electronics
www.vancebaldwin.com
7060 State Road
Ft. Lauderdale, FL 33317
Tel: (800) 432-8542
Fax: (800) 552-1431

Hitachi's Service Web Site

Your Key Source of Information and Online Help

Our service Web Site is a convenient way for you to communicate with Hitachi. It will be the key source of the information you need to provide excellent service. Here's what is at your disposal 24 hours a day, 365 days a year.

- **Technical Services Information:**
  - ◆ Contacts and email information
  - ◆ Symptom-Cause Data
  - ◆ Frequently Asked Questions
  - ◆ Technical Publications
    - ❑ Service Manuals
    - ❑ Hi-Lite Publication
    - ❑ Current and Archived Training Seminars
    - ❑ Service Manuals
    - ❑ Tech Tips
    - ❑ Service Bulletins
  - ◆ Downloadable Files
- **Parts Information:**
  - ◆ Contacts and email information
  - ◆ Critical Customer Parts Expedite for resolution of back orders
  - ◆ Parts Database
  - ◆ Technical Publications
    - ❑ Part Number Look-up
    - ❑ Substitutions
    - ❑ Part Cost
    - ◆ *Critical Parts Expedites*
- **Field Service Information:**
  - ◆ Contacts and email information
  - ◆ "How Do I?"—Policy and Procedures Guide
    - ❑ How to order parts
    - ❑ How to return parts
    - ❑ Board and CRT Return Instructions
    - ❑ How to file warranty claims
    - ❑ Special Authorization claims
- **Customer Service Information:**
  - ◆ Contacts and email information
  - ◆ Links to other related sites

The Hitachi Service website, is constantly updated, so check back frequently for the latest information on Hitachi products, and any changes in our policies or procedures that might affect your Hitachi Warranty Service activities.

Servicing Electric Guitar Amplifiers

By Sheldon Fingerman

If you service consumer electronics products, sooner or later somebody is going to ask you to repair an electric guitar or guitar amplifier. Before you say no, you should realize that most musicians are pretty desperate to get these things fixed, tend to be very grateful, and many of these repairs are fairly simple if you know what to look for.

Types of Guitar Amps

Guitar amps (Figure 1) are no different than any other amp, and come in three distinct flavors: Solid-state, tube, and hybrid. Solid-state amps are reliable, sound pretty good, and travel well. They are also the easiest to repair, as many of the components are off-the-shelf transistors, resistors and capacitors.

Tube amps are the preferred choice of most musicians, mostly for sound quality, but they tend to be pricey, require more maintenance, periodic tube replacement, and don't hold up as well to the rigors of being hauled from gig to gig.

Hybrids are a combination of the two, trying to marry the science of solid-state technology with the tube-sound most musicians prefer.

Guitar amps can also be broken down into combos and separates. Combos combine the head unit (amplifier section) and speaker cabinet into one unit. Some musicians, however, prefer to purchase the amp and speaker(s) as separate units. Either way the principles are the same: it's just one box or two.

Sometimes Distortion is a Good Thing

Because most guitarists like to distort the sound, giving it a bit of a "crunch," guitar amps generally have separate controls for the preamp and power amplifier stages. This allows the musician to crank up the preamp stage, distorting the signal before it gets to the power amp, then easily vary the volume using the main volume control. If guitar amps weren't made this way, you would have to crank up the main amplifier section to get a distorted signal, then figure out a way to suppress the volume.

Less Complicated Than They Look

While the control panel of a high-end amp may resemble the dashboard of the Starship Enterprise, it's not as complicated as it looks. Some amps have controls and circuits for special effects, and some have two distinct channels, so the musician can quickly move from one sound to another (rhythm and lead).

Figure 1. Fender Champ 12 amp sitting on bench.

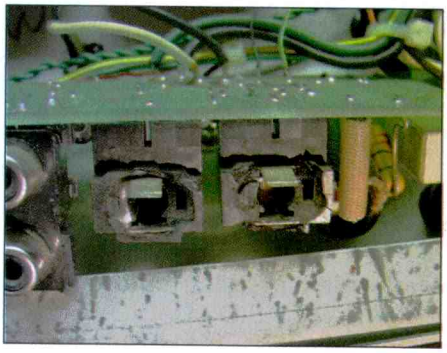


Figure 2. All of these inputs were damaged, yet still worked. All were replaced.

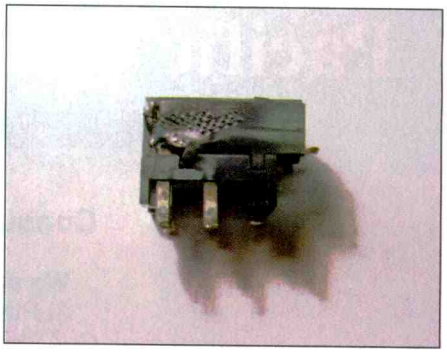


Figure 3. This jack was a little too close to a hot resistor. It was replaced, and the resistor was repositioned away from it.

Figure 4. The chassis partially removed from the cabinet. Note the amp was turned on its side to aid removal.

Figure 5. A bit of clear nail polish should lock these nuts in place preventing future problems.

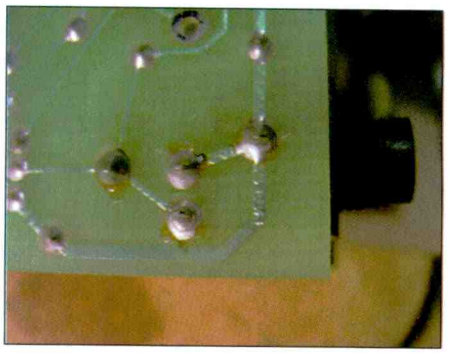


Figure 6. Even with all the obvious physical damage, here is the main reason the amp was brought in for repair: intermittent sound because of CSJs.

If you are unfamiliar with the amp's controls, don't be afraid to ask the customer. Simply explain that you are unfamiliar with this model and ask if they can bring in the manual. Finding the original manual may be a long shot as amps tend to get sold and resold. However, if you have access to the Internet you should be able to turn up all the information you need, including owner's manuals and even schematics.

Common Problems

Regardless of what kind of amp you are faced with, they all seem to share common problems. And, like most audio repairs, you will be faced with either no sound, intermittent sound, or strange sounds.

If you get an amp that has no sound, use the same techniques as with any audio repair. First, is it the amp or the source? Did the musician try another guitar and cable? The owner may have already have tried this. But, maybe not. And, you don't have to play a lick to fix guitar and bass amplifiers. A signal generator will do just fine, and provides a better method for diagnosing "no audio" problems.

Preparing to Service a Guitar Amp

As with any audio repair, turn down the volume controls before starting, and set all tone controls to center. With the amp set at minimum levels, hook up a guitar or signal generator to the input. Be extremely careful if you use a signal generator, as the output from most guitar pickups is passive and very weak. You are merely trying to duplicate the signal coming from a vibrating metal string over a magnet surrounded by a coil, so you don't need much input.

No Sound

Also, begin with a generic frequency of some kind that's easy on the ears and the amp. I usually start somewhere around 1000Hz. Slowly turn up the preamp "Gain" control a bit, if the amp has one, and then turn up the main volume. If you get to the halfway point with no sound try turning up the generator a bit, and if you still have no sound shut everything down.

Most amps have a power indicator lamp, but it may not be working so don't rely on that as a guide. Again, check all the controls to make sure you haven't missed anything that might be preventing a signal from getting through. Most tube amps use a standby switch that allows the amp and tubes to stay warm when the amp is not in use, but cuts off the source signal. Some amps have an effects loop with a switch that closes it. And In rare cases you may find an amp that requires a patch cord or link between the preamp and output stages. No link, no sound.

If you still have no sound check the speaker. The rear of most amps is open allowing easy access to the speaker(s), and an ohmmeter can be easily used to check it. Blown speakers are not uncommon on guitar amps, and using your signal generator and a scope it's easy to check for output to the speaker; just don't forget to use a dummy load. If the amp has both a woofer and tweeter, and the tweeter seems to be out, check for a switch on the back of the amp that cuts out the tweeter. It's all too easy to miss this switch and begin an unnecessary repair. And don't assume the owner is aware of this common mistake.

Check the Inputs

Look over the front and rear panels for any signs of damage. Inputs are a prime source of trouble (Figure 2). While famous musicians who make millions often use wireless inputs, the average player uses a cord - that's been pulled to its extreme on more than one occasion, tripped over, or both. These inputs are often soldered directly to the circuit board and secured to the chassis by a nut. When the nut falls off, as they often do, it is rarely replaced, leaving nothing but the solder joints to hold the jack in place. You don't have to be a rocket scientist to figure this isn't going to last very long. If the jack looks damaged you will have to replace it.

Removing the Chassis

If you haven't found anything wrong at this point, or you've found some obviously damaged controls or input jacks (Figure 3), you're going to have to remove the chassis (Figure 4). It's not that difficult, and a general rule is that the main chassis is held in place by screws

Figure 7. Generally, the screws holding the chassis in place are on top of the cabinet.

Figure 8. The main circuit board removed. Every nut on every control and jack had to be removed to get this far. Also, what looks like a cardboard box is the reverb unit.

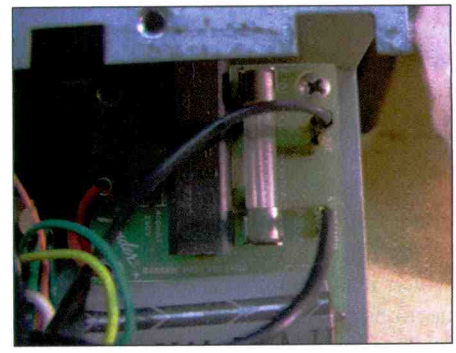


Figure 9. An internal fuse that would not be readily seen without removal of the chassis.

Figure 10. A lot of hand wiring and soldering go into most tube amps.

Figure 11. Most tubes hang upside down, and are held in place by metal retainers. Tube removal is a two-handed operation.

Figure 12. Removal of the output jack plate to get to the jack. Note that this particular guitar has midi circuitry, requiring a jack that cuts out this circuit whenever a plug is inserted.

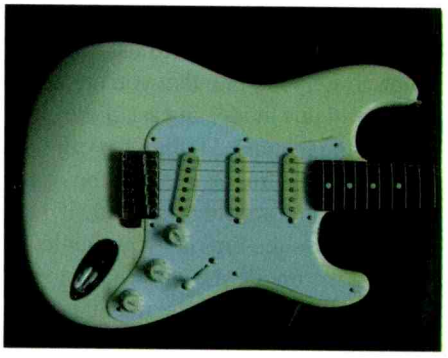


Figure 13. A typical 3 pickup Fender Stratocaster, one of the most copied guitars in the world. All controls and pickups are attached to the pickguard, and that five-way pickup switch can get pretty dirty.

from the top of the cabinet, and possibly a few in the side. Back the screws out carefully, making sure they do, in fact, back out. Sometimes the screws are held in place by nuts secured to the chassis, and sometimes the nuts come loose. Often, a bit of epoxy putty will hold these in place for easy reassembly (Figure 5).

Work carefully, checking what is happening to the chassis as you loosen and remove screws. Also, the screws securing the carrying handle may be holding the chassis in place. It may be advantageous to work with the amp on its side, using your bench or the floor for support as you remove the chassis. This method allows you to use gravity as your friend, instead of your enemy.

Once the screws are out, the chassis will either remove from the front or the back of the enclosure. Try both ways to see which it is, and check for speaker connections and any other wires that may be leading to a reverb or other external device mounted in the cabinet. If necessary, disconnect these wires noting where they go.

Guitar amps tend to be covered with a vinyl covering that can impede removing the chassis. If you are having a lot of trouble, and are sure you got all the screws out, see if this covering is folding and binding somewhere. This stuff may also give you trouble on reassembly, too. A bit of adhesive may help, but you might have to cut some of this stuff away. Use good judgment, however, as you don't want the amp to look damaged once reassembled.

Look Around

Once inside, look carefully for any burned or loose components. The owner of the amp may not want to admit that it went down a flight of stairs or was kicked off a stage at a concert. Hey, it happens, and often the exterior of the amp will show nothing other than normal wear and tear.

You may find that the circuit board is installed component side down. This is good and bad. Good, because it will be easy to spot a damaged or cold solder joint (CSJ) (Figure 6). Bad, because if you have to replace a component it will be necessary to remove the board, and it's often held in place by nuts on every input and control (Figure 7). Removal can be time consuming, but there's not much you can do about it. Just take your time, and inventory all those screws, nuts, washers, and spacers like a surgeon. You definitely don't want any leftover parts when the job is completed (Figure 8).

By the way, if you're going to work on a live chassis, watch out for charged capacitors, and take the usual precautions you would with any live piece of electronic equipment. Also, guitar amp technology is pretty basic, and some is downright ancient, so it's a good bet the chassis is grounded.

Very often you will find some CSJs on an input or control. This is often caused by a missing nut, physical damage, or just age. Controls are sometimes generic, but inputs are often not. Regardless, it's best to use OEM parts, and companies like Fender will get them right out to you. They know music is a business to many people, and an amp that's out of commission may mean lost wages to a musician. And, while schematics and a parts lists are nice to have, they aren't always necessary. A phone call to the manufacturer describing the model and part will usually do.

If you're going to take musical amps in for repair, it's not a bad idea to have a few extra input jack nuts on hand, to replace missing ones, and as long as you're in there replace any jacks with stripped threads. Inputs and controls are cheap, and it's easy to replace any suspect parts while you have the chassis out. The customer will thank you for your attention to detail, and the price of the repair won't be much higher.

Check for Fuses

Look carefully for internal fuses (Figure 9). While the main fuse, which is usually accessible from the outside of the chassis, may be good, one of the internal fuses could be blown. A blown fuse can mean anything from a short, to a bad tube, to worn out capacitors, to an overzealous musician. Use common troubleshooting techniques and look very carefully for CSJs and bad solder joints. Instrument amplifiers tend to live hard lives, and being turned on after sitting overnight in a freezing car or van doesn't help.

Why Tubes?

If you're not a guitar player, or an audiophile, you may wonder why anyone would even consider using tubes (Figure 10). As you know, or may not know, most transistors "clip" with a very distinct and

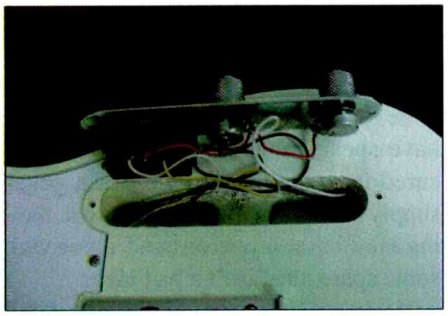


Figure 14. Another highly copied guitar, the Fender Telecaster. This view shows the Tele Control Panel. Fortunately on this model, the controls and switches are easily accessible by removing two screws on a metal plate.

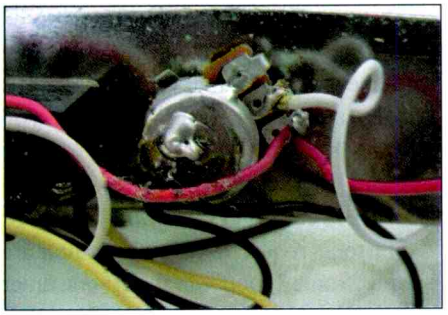


Figure 15. This view shows the Tele Controls closeup. Note that the grounds and some tabs are often soldered directly to the body of the pot. When in doubt, resolder, and clean all the controls while you're in there.

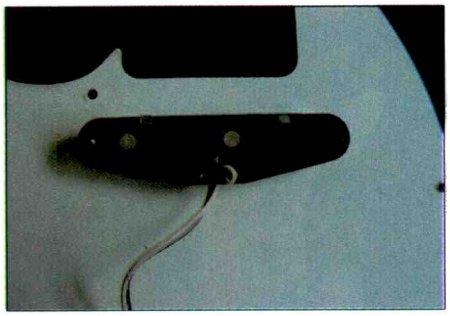


Figure 16. A typical magnetic, passive pick-up. You can easily see where the windings are soldered to the main wires.

sharp square wave when pushed to their limit. Tubes, on the other hand, clip with a soft curve. Since many guitarists like to push their amps to extremes, tube amps can deliver a distorted signal that doesn't sound harsh. While this may seem strange, one of the nice things about guitar amps is their ability to deliver a large variety of sounds.

You may not want to service tube amps, but common problems like bad solder joints abound in tube amps, and replacing a tube is an easy diagnostic test (Figure 111). However, while replacing a tube may seem to be an easy fix, tubes should be replaced in matched sets, and the procedure may involve having to "bias" the amp. Amp biasing is more of an art than a science, and goes far beyond the scope of this article. Both amp manufacturers and tube manufacturers can give you the information and specs you need to delve into this world, and you can get a biasing tool from the manufacturer of Groove Tubes, an excellent

Figure 17. This is a Tele with pickguard lifted. With only two pickups, one attached to the pickguard, a "Tele" is about as simple as an electric guitar can get.

company with great support.

Heat Problems

Another problem with tube amps is all that heat, which can destroy capacitors and other components over time. A vintage tube amp that seems to have problems for no apparent reason may require that all of the caps be replaced. This can be a lucrative repair, and the manufacturer will often assist you. Vintage amps are all the rage these days, are appreciating in value, and are usually worth the effort and expense. Any qualified technician can easily perform these types of repairs. You just have to figure out what components need to be replaced, and replace them all at the same time.

The Guitar Needs Service Too

For the most part, electric, solid-body guitars are even easier to repair than amps. Leaving out esoteric models with active pickups and midi (musical instrument device interface) circuitry, all you have is a magnetic pickup, or pickups, attached to several controls leading to an output jack. See Figures 12 through 17 for several views of various guitars.

The problems you encounter will almost always be related to bad or dirty potentiometers, dirty switches, bad solder joints, and loose output jacks. The repairs are easy, but you must be extremely careful not to damage the guitar in the process. Always use blankets, clean soft rags, newspapers, paper towels, or anything that will prevent scratches and dings. Guitar finishes are extremely difficult to repair, and you even have to be careful with older instruments. The scratches and wear marks on them add a certain amount of character that you don't want to alter.

Tools for Servicing a Guitar

The tools required to repair a guitar are simple: Some "good" screwdrivers, tuner cleaner/wash, and a soldering iron or gun. Any amp will do, but even a cheap guitar amp will aid you immensely, as a scope will only give you a go/no go verification. You can plug an electric guitar into a bass amp, but if you plug an electric bass into a normal guitar amp keep the volume very, very low. Guitar amplifiers and speakers are not meant to handle the low frequencies of a bass, and you could blow the amp.

Guitar Problems

Rarely will you ever find a bad pickup, so look at the pots, switches and solder joints. "Scratchy" controls are easy to fix with a shot of any good tuner cleaner, and controls and switches can get so dirty you may get no sound at all. Always try cleaning before replacing.

Getting to these controls can be a pain. Some are attached to the pickguard, and the strings may have to be loosened or removed to get to them. If you are lucky, the controls may be on separate plates negating the need to mess with the strings. Using a screwdriver (of the proper size with a tip that's in excellent condition) carefully remove the pickguard or plate. Be careful when pulling up on anything, as the wiring will have to be routed exactly as it was when the guitar was manufactured. Reassembly should not be a struggle, and there shouldn't be any lumps or bumps where a wire is caught between the pickguard and the body.

Look for bad solder joints, especially to ground. When in doubt - resolder. And, again, be especially careful protecting the body and finish from scratches and errant solder spills.

Loose output jacks are easy to fix, but you may have to remove the plate holding the jack to tighten it. It's the same with loose control pots. If a pot seems really loose it may have taken a hit. See if you can use pliers to tighten the tabs holding the pot together. If not, the pot may have to be replaced. These pots are cheap, but have special shafts and should be procured from the manufacturer or a guitar supply house. If you really get into it, having a few of these pots on hand, along with some spare nuts, isn't a bad idea.

If you've checked everything and still get no sound, it may be a bad pickup. Use an ohmmeter to check the windings, and if they appear open, check the solder joints where the main wires are connected to the pickup's windings. A bad solder joint there is much more likely than an open winding.

Completing the Repair

Once the repair has been made, you may find when you replace the screws one or two may be stripped. First, you are going into wood so don't crank on them very hard. Some of these woods are quite soft, and it's possible the threads were gone when you got it. Don't use anything that would prevent disassembly in the future. Often, a piece of toothpick in the screw hole to take up the slack is all it takes to solve the problem.

If you are a player, testing should be fun. If not, plug the guitar in using a good cord, and just hit a few notes trying to duplicate the problem. While electric guitars may be simple to repair, the job often involves having to restring and tune the instrument, but all it takes is one string with a bit of tension on it to test a repair.

Team Up With a Music Store

Whether you play guitar or not, partnering with a local music store may be just the ticket. Some music stores are desperate to find good techs, if for nothing else than to solder a loose wire now and then. They have plenty of amps to test your work, they know how to restring a guitar and check it out, and it's one of those marriages that always work out in the long run.

Most of all, don't be afraid of these repairs. They can add quite a bit to your bottom line, and if you do a good job in a timely manner local musicians will be lined up at your door. ■

Photofact® Index

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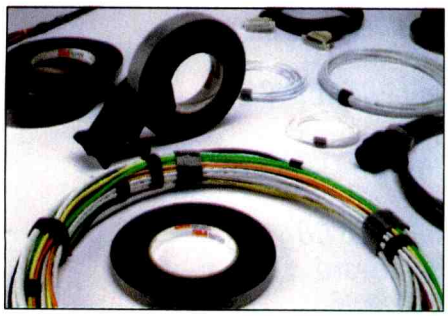
New Products

Hook & Loop Fasteners

3M now has available a one-piece hook and loop fastener. With the 3M brand 100 Hook and Loop Mechanical Fastener, assemblers are able to bundle wire and cable faster and with less effort and strain



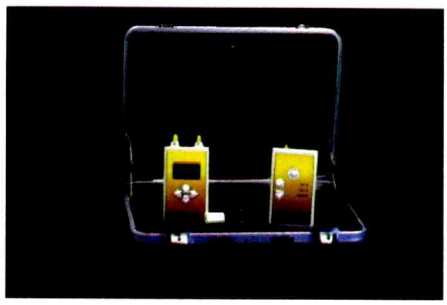
than with plastic ties, wire ties or string.

These fasteners incorporate flexibility, a thin profile and superior strength for cable bundling, harnessing and wire fastening systems. The patented design gives a reliable hold with less force and eliminates work-in-process damage due to abrasion, crimping or cutting. These fasteners can be reused up to 10 times, eliminating waste and saving dollars. A variety of widths are available on uncut and perforated rolls.

3M
Circle (16) on Reply Card

Fiber Optic Test Kits

Fotec has introduced new "Smart" Fiber Optic Test Kits that can cut fiber optic network testing time in half by automated dual wavelength testing. The DT300 and DT3000 series kits are available for both multimode and singlemode fiber networks.



Test specifications for most systems now call for dual wavelength testing. With multimode LANs, it's 850 and 1300 nm, while for telcos and CATV, its singlemode at 1300 and 1550 nm. Until now, multimode testing simply meant testing everything twice, while for singlemode it meant paying more than twice as much for complicated instruments that were difficult to use.

The built-in intelligence of "Smart Instruments" allows the user to make these two tests automatically. The D5300 series Smart Sources encode wavelength information which is recognized by the DM300 and DM3000 series power meters during testing. The meter records loss data including wavelength and saves it in a unique cable/fiber database that can store up to 500 tests in the meter before transferring the data to a PC. To further speed up testing, the DT3000 kits can measure loss on two fibers at once.

Fotec
Circle (17) on Reply Card

Hi-Speed Connector System for Consumer Electronics Applications

ITT Industries, Cannon has introduced a new, high-speed connector connection for almost any consumer electronics device.

This IEEE 1394 FireWire host connector allows multiple connections from a single personal computer port, making the product suited for the PC, storage and consumer electronics markets.

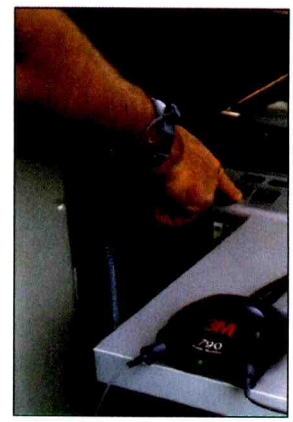
IEEE 1394-compatible products allow consumers to transfer video or still image from a camera or camcorder to a printer, computer or television without any image degradation. This connector allows real-time and asynchronous data to be transmitted through a single connection. The connector also allows both low and high-speed data devices to operate on the same network.

The IEEE 1394 FireWire connector system is fully cabled and is especially designed for applications such as nonlinear (digital) video presentation and editing, desktop and commercial publishing, document imaging, home multimedia and personal computing.

ITT Industries
Circle (18) on Reply Card

Static Monitor

The Monitor measures the voltage potential on a person referenced to earth ground. An operator simply inserts a dual conductor ground cord into one of the input jacks located on the monitor. A slide switch is used to select the voltage level necessary for the specific job being performed. For example, 1V and 3V levels are used in disk drive and wafer fabrication manufacturing; 6V and 9V levels can be used for less sensitive work, such as PCB assembly.



Three distinct visible and audible alarms identify existing conditions: exceeding voltage level set limit, loss of contact between arm and wristband, or monitor disconnected from ground.

3M
Circle (19) on Reply Card

B+K Precision Introduces Portable, Lightweight Network Cable Testers

B+K Precision Corporation, suppliers of test and measurement products, announces the addition of two new portable, lightweight network cable testers, the Model 230A Multi-Network Cable Tester, and the Model 231A Deluxe Multi-Network Cable Tester. These low-cost, battery powered cable testers can be used for testing just about any network cable in fractions of a second.

The Model 230A Multi-Network Cable Tester Can Be Used To Test Ethernet (BNC). 10Base T (UTP/STP) And Other Network Cables

The Model 230A is a portable, battery-powered, stand-alone network cable

New Products

tester that can be used for testing most popular network cables such as thin Ethernet (BNC), 10Base T (UTP/STP), 100BaseTx, RJ45, 356A, TIA-568A, and Token Ring cables.

Weighing only 0.38 pounds and measuring a compact 2 3/8" wide 1" deep by 4.25" high, the Model 230A Network Cable Tester, complete with a protective rubber boot, belt clip and a remote terminator storage compartment, is priced at $69, quantity one and is available for immediate delivery.

The Model 231A Deluxe Multi-network Cable Tester Can Easily Read Correct Pin Configurations Of Most Popular Network Cables.

The Model 231A is a portable, battery-powered, stand-alone network cable tester that can be used to easily read the correct pin configuration of 10Base T cable (category 5), 100BaseTx, 10Base2 cable (coax) and RJ45/RJ11 modular cables, 356A, TLA-568A, TIA-568B and Token Ring cables by comparing one transmitting end to the corresponding receiving end.

Weighing only 0.40 pounds and measuring a compact 2 3/8" wide by 1" deep by 4.25" high, the Model 231A Deluxe Multi-Network Cable Tester, complete with a protective rubber boot, belt clip and a remote terminator storage compartment, is priced at $79 quantity one and is available for immediate delivery.

B + K Precision Corporation products are available worldwide through a global network of authorized distributors.

BK Precision Corporation
Circle (20) on Reply Card

Wire Cutter and Stripper

A new combination wire cutter and stripper that features a thumb adjustable cam for easily setting the tool to accommodate a desired wire size is being introduced by Xuron.

The Model 501 Wire Cutter/Stripper is a combination hand tool that features a thumb adjustable cam for easily setting the tool to accommodate wire sizes from 10 to 26 AWG for stripping; without requiring other tools. Ergonomically designed to fit into large and small hands comfortably, it has cushioned handgrips and a Light-Touch return spring.

Xuron
Circle (21) on Reply Cards

Handheld Thermal Wire Strippers

The Eraser Company manufactures quality wire strippers including the

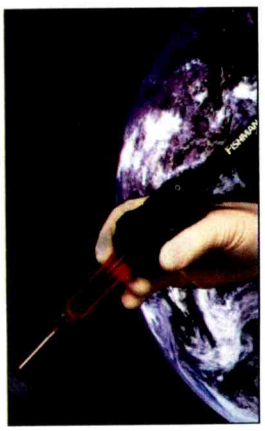
Handheld MH10 Thermal Wire Stripper. The MH10 strips thermoplastic insulations from solid and stranded wires between 12-43 AWG (2.06 - .056mmø) without damage to conductors. The heating elements are activated by depressing a foot pedal and can reach an operating temperature of 1400°F (760°C). The element depth and strip lengths are easily adjusted. The unit is easy to set up and operate.

Based in Syracuse, NY since 1911, The Eraser Company manufactures a wide-range of industrial products, including wire and cable cutters, wire strippers, wire twisters, wire brush wheels, fiber optic tools, dereelers, infrared heating equipment, measuring tools, and fiberglass brushes. The company is ISO 9001 certified. The company offers Free E.S.P. (Eraser Sample Program). Send 10-20 feet of your material and Eraser will recommend the best solution for your wire and cable processing needs from its line of more than 200 products.

Eraser
Circle (22) on Reply Card

Fluid Dispensing System Features Precise Air-Free Performance

A fully programmable, electric powered and mechanically operated system that is air-free for precisely dispensing any viscosity fluid or adhesive is available from Fishman Corporation of Hopkinton, Massachusetts.



The Fishman LDS9000 Mechanical Dispensing System features an easy to program control unit and a hand-held dispensing gun that employs a precise, linear actuator-driven piston to push a fluid or adhesive through a plastic syringe. Permitting totally repeatable shots, this air-free dispenser runs on 115 VAC and eliminates the problems associated with conventional air dispensers such as variations in pressure, moisture, and fluid viscosity.

Suitable for in-plant assembly and field maintenance, the Fishman LDS9000 Mechanical Dispensing System has a microprocessor-based portable control unit, a foot- or hand operated pedal, and gun stand. Providing uniform and repeatable shots, the software-driven unit knows the I.D. of the syringe, dispense rate, and the required volume and then calculates the precise distance the piston needs to travel. It even draws back to prevent oozing.

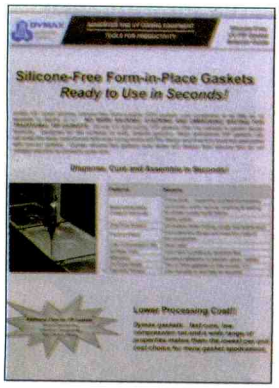
The Fishman LDS9000 Mechanical Dispensing System is priced at $1,876.00 and a two-week in-house trial is offered. Literature is available on request.

Fishman Corporation
Circle (23) on Reply Card

Literature

Selector Guide Describes New Line of Formed-In-Place Gaskets

A Selector Guide describes a new line of silicone-free Formed-In-Place (FIP) Gaskets being offered by the Dymax Corporation. The brochure describes the benefits of the new GAl 00 Series FIP gaskets and how they represent new technology different from the typical UV silicone, urethane, and hot melt gaskets currently in use. Curing completely in seconds upon exposure to UV light, these new FIP gaskets allow the manufacturer to dispense, cure and assemble parts in one continuous process.

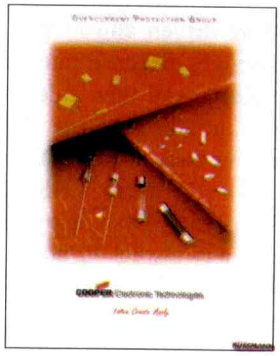


The selector guide features 5 new FIP gaskets and lists properties defining each that include: adhesion to substrates, hardness, compression set, thermal range, water absorption, cure depth, and viscosity. Viscosities for the products range from 450 to 60,000 cP and compression sets are generally in the range of 5 to 10%. These new FIP gaskets have found use in automotive, consumer, communication, electronic and medical device applications. The brochure features diagrams showing the types of flanges for which FIP products are recommended and flanges where "0" rings are a better choice.

Dymax Corporation
Circle (24) on Reply Card

Electronic Fuses Technical Guide

The new 136-page technical design guide for Cooper Electronic Technologies' line of Bussmann electronic fuses aids engineers in the selection of overcurrent protection solutions for a variety of applications.



The guide features a section on basic fuse operation, application, and selection criteria. It also includes specifications for surface mount, axial and radial leaded print circuit board fuses; traditional ferrule type fuses; automotive blade fuses; and accessories such as fuse clips, fuseholders and fuseblocks.

Easy-to-read product specification charts include voltage and interrupting rating, resistance range, typical melt and voltage drop. Other useful information includes electrical approvals, environmental operating data, dimensions, land pattern, soldering methods, and ordering instructions.

Cooper Electronic Technologies
Circle (25) on Reply Card

Cable Assembly Catalog

RF Connectors, a division of RF Industries, new 128 page catalog offers nearly 60,000 stock cable assemblies featuring the company's line of coaxial connectors, solid center contacts, dual-wall tubing for strain relief and fabrication using only US manufactured coaxial cables. This product line also includes USB, fiber optics and other molded cables.

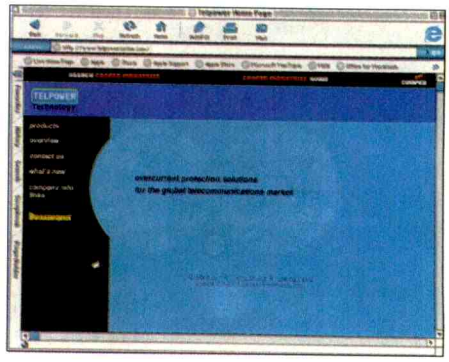
More than 10,000 variations of standard connector interfaces terminate 64 popular coaxial cable types to create this broad selection. Custom assemblies are also available with short lead times.

RF Connectors
Circle (26) on Reply Card

Circuit Protection Technology Information on the Web

Twenty-seven different circuit protection devices for power products and 41pages of technical information are featured in the new website, (www.telpoweronline.com), from Cooper Bussmann Telecom Products.

Besides product information, telpoweronline.com has a wealth of information that covers many aspects of DC power interruption ratings and power protection for DC products. Schedules of special training seminars are also available.



Cooper Bussman
Circle (27) on Reply Card

Surge Suppression CD-ROM

Intermatic announces the availability of a complimentary, limited edition CD-ROM that will automatically assess surge suppression needs for facility managers.

The easy-to-use CD-ROM asks users a series of eleven questions - the very same questions the very same questions Intermatic's experienced professionals would ask when helping customers select a surge suppression product.

The CD-ROM features an interactive isokeuronic map to help customers determine their facility's susceptibility to lightning strikes. Also featured is a full list of Intermatic surge suppressors and model specifications, including full details on the advanced surge suppressors, the Intermatic Panel Guard 3000-5000 series.

Intermatic Incorporated
Circle (28) on Reply Card

New Website from CEDIA

The Custom Electronic Design and Installation Association (CEDIA) has launched a redesigned web site with enhanced features and tips to guide homeowners and complementary trade professionals through the complexities of home networking.

The web site, www.cedia.org, serves as a central clearinghouse of information for the 2,000 CEDIA members worldwide, as well as homebuilders, interior designers, architects, and home owners.

Custom Electronic Design & Installation Association
Circle (29) on Reply Card

Books

New CMOS Book

Sams Technical Publishing announces the release of *CMOS Sourcebook* by Newton C. Braga.

Newton Braga brings CMOS applications into the 21st century, applying this long-used technology to today's technology. The popular CMOS Cookbook by Don Lancaster was last updated in 1997. Newton builds upon Lancaster's excellent coverage of this subject, taking the reader through the details of CMOS while building upon a digital electronics background.

A CD-ROM containing datasheets for the Philips Semiconductors HED4000 CMOS family is included with this book.

Sams Technical Publishing
Circle (30) on Reply Card

RCA/GE/PROSCAN TV Miscellaneous Service Adjustments

Author: Sams Technical Publishing
ISBN: 0790612429 / SAMS#: 61242
Pages: 336 / Paperback
Price: $34.95 US

A MUST for the traveling service technician! RCA/GE TV Miscellaneous Service Adjustments is a compilation of Miscellaneous Service Adjustments including Factory On Screen Menu settings on the newer sets found in PHOTOFACTS covering RCA/GE televisions from 1994 to 2001. Covering over 530 models, this gathering of facts, figures, adjustments and other information will be a tool that every service technician wants to have in his or her toolbox!

Allows a service technician to carry important information grouped by manufacturer. An excellent tool for technicians of any level. An essential tool for in-home repairs.

Sams Technical Publishing
Circle (31) on Reply Card

Exploring LANS for the Small Business & Home Office

Author: Louis Columbus
ISBN: 0790612291 / SAMS#: 61229
Pages: 304 / Paperback
Price: $39.95 US

Exploring LANs for the Small Business and Home Office covers everything from the fundamentals of small business and home-based LANs to choosing appropriate cabling systems. Columbus puts his knowledge of computer systems to work, helping entrepreneurs set up a system to fit their needs.

Includes small business and home-office Local Area Network examples. Covers cabling issues. Discusses options for specific situations. Includes TCP/IP (Transmission on Control Protocol/ Internet Protocol) coverage. Coverage of protocols and layering.

Louis Columbus has over 15 years of experience working for computer-related companies. He has published 10 books related to computers and has published numerous articles in magazines.

Sams Technical Publishing
Circle (32) on Reply Card

PIC: Your Personal Introductory Course, Second Edition

Author: John Morton
ISBN: 0-7506-5038-9
Pages: 288 / Price: $26.95

Auniquely concise and practical guide to getting up and running with the PIG Microcontroller. The PIG is one of the most popular of the microcontrollers that are transforming electronic project work and product design, and this book is the ideal introduction for students, teachers, technicians and electronics enthusiasts.

The step-by-step explanations make it ideal for self-study : this is not a reference book - you start work with the PIG straight away.

CONTENTS: Introduction; Exploring the PIG5x series; Exploring the P16G71; The PI2C5Ox series; The P1 6G84 series; Looking to the future; Sample programs; Index.

Newnes Publishers for the Electronics Industry
Circle (33) on Reply Card

Animatronics: Guide to Holiday Displays

Author: Edwin Wise
S ISBN: 07906121940 / SAMS#: 61219
Pages: 304 / Paperback
Price: $29.95

Author Edwin Wise takes the reader inside his world of robotics in an innovative guide to designing, developing and building animated displays centered around the holidays of Halloween and Christmas.

Sams Technical Publishing
Circle (34) on Reply Card

Applied Robotics

Author: Edwin Wise
ISBN: 0790611848 / SAMS#: 611840
Pages: 328 / Paperback
Price: $29.95

About the book: A hands-on introduction to the field of robotics, this book will guide the hobbyist through the issues and challenges of building a working robot. Each chapter builds upon the previous one, extending a core robot project throughout the book. Examples of chapters include: Mechanical Platforms, Power Supplies, Adding Sense, Microcontrollers, Insect Robots, Pneumatics, More Behaviors and Intelligence, Programming Projects, Robot Behaviors, and much more.

Sams Technical Publishing
Circle (35) on Reply Card

Robotics, Mechatronics, and Artificial Intelligence

By Newton C. Braga
ISBN: 0-7506-7389-3
Pages 336 / Price: $29.99

- Provides inexpensive and creative robotics projects, for enthusiasts of any level of experience
- Covers a wide range of electronics disciplines including interfacing with computers, home automation, mechanics, and many more
- Offers comprehensive project blocks that make it possible for readers to pick and choose the circuit elements for individual robotics projects

Contents: Fundamentals of of Robotics and Mechatronics, Motion Control, Using Transistors for the Control of Motors, Solenoids, and Relays, H Bridges, Linear and PWM Power Controls, Power Controls Using Thyristors, Solenoids, Servos, Shape Memory Alloys, Stepper Motors, On-Off Sensors, Resistive Sensors, Operational Amplifiers and Comparators, Remote Control and Remote Sensing, Logic Blocks, Intelligence and the Computer, Light & Sound Effects — Other Blocks.

Newnes
Circle (36) on Reply Card

Association News

Certified Service Center Program Unveiled by Appliance & Electronics Service Industry Groups

Representatives from six major appliance and TV/electronics service industry trade associations have launched the long-awaited Certified Service Center (CSC). The program has been under development for more than four years.

"The purpose of this voluntary program is to encourage professionalism within the service industry and publicly identify those firms to strive to be honest, competent and professional in their dealings with customers," said Randy Whitehead, president of the National Association of Service Dealers (NASD). "To do so, service firms must meet minimum industry standards, and to be certified in compliance through one of the CSC-participating service associations."

Participating associations are the Consumer Electronics Association (CEA), Electronics Technicians Association International, the National Electronics Service Dealers Association, National Association of Service Dealers, the Professional Service Association and the United Servicers Association.

To be CSC certified, each service firm must abide by the CSC Code of Ethics. Firms must have the proper tools and approved test instruments for all categories of products they service and must employ technicians and service managers whose skills have been verified by an approved industry certification program. These businesses must meet all federal, state and local licensing requirements and maintain business liability and customer merchandise insurance.

Certified firms shall have a written communications plan for notifying customers of all service delays. Firms must have and abide by a written customer relations program that includes a complaint resolution process and must maintain a neat and clean appearance, have a written dress code for employees, and display prominent signage outside identifying the firm.

Firms seeking CSC certification must apply on designated forms and pay a fee to one of the participating associations. Should a firm be found not in compliance with a CSC standard, it will be given six months to correct the problem, and upon reinspection be awarded CSC certification. All firms must be re-certified every three years, Whitehead says.

Certified firms are encouraged to advertise their certification as a means of holding themselves as being a cut above other local competitors.

For additional information, contact one of the participating service trade groups:

CEA
703-907-7045
Electronics Technicians Association
765-653-4301
National Electronic Service Dealers Association 817-921-9061
National Association of Service Dealers 630-953-8950
Professional Service Association
518-237-7777
United Servicers Association
714-335-1951.

NARDA Salary Survey for Appliance/Electronics Sales & Service Announced

The North American Retail Dealers Association (NARDA) is sending out survey forms to more than 2000 companies in order to compile the industry's first employee compensation report, according to association president, Michael Fisher, Nielsen's Inc., Spencer, Iowa.

The forms are going to appliance, electronics and furniture retailers, including self-servicing dealers, and independent service agencies.

"We are frequently asked questions about salaries, commissions and benefits for the people who work in our industries," Fischer reported. "Until now there hasn't been a comprehencsive report that would help business owners make decisions about employee compensation."

Fischer urged dealers who receive the form to fill it out and return int as quickly as possible. "NARDA members who return the questionnaire will get a free copy of the report. Non-members who return the questionnaire will get a copy for $50.00. I am sure that they will find the report extremely useful," he siad. "They will be able to see what other retailers and servicers their size and in their regions of the country pay their employees. They can use the iformation to remain competitive and control their personnel costs.""If they don't get a questionnaire in the mail, they can download one from the NARDA web site, www.narda.com. The link is gright on the home pate."

The postions to be surveyed are owners/officers, sales associates and managers, service technicians and managers and administrative personnel.

Compensation questions about salary, overtime, commissions, bonuses and incentives are also included in the survey as are benefits questions regarding vacations, holidays, insurance, training, pension plans, flex time and others.

The printer report will analyze the results by type of company, sales volume and region of t he country. It is scheduled to be published in August 2002.

ETA Announces Officers for 2002

The following officers were elected at the ETA meeting in Orlando, FL, March 9.

Chairman: William Woodward, FOI

Vice Chairman: Clark Adams, CETsr

Treasurer: Bill Rivers, CETsr

Secretary: Rick Thayer

Comm Division Chairman: John MacLeanIII, CET

Com Sec/Treasurer: Rollin Okerberg, CET

Educ. Div. Chairman: Doug Hubert, CET

Educ, Div. Sec/Treas: Steeven Maybar, FOI

Cert. Tech Division Chariman: Greg Hake, CETsr

Cert. Tech Division S/T: Randy Reusser, CETsr

Shopowner Div. Chairman: Gilbert King

Shopowner Div. S/Treas: Leon Howland, CET

Chapter Relations Director: Josh Wendell

Cabling Div. Chairman: John Limtiaco, FOI

Cabling Div. S/T: Jim Parker

For more information contact The Electronic Technicians Association, 502 N. Jackson, Greencastle, IN 46135. Eta@tds.net.

CEDIA BOOT CAMP TEACHES WORLD-CLASS CUSTOM INSTALLATION FUNDAMENTALS

Registrations are still being accepted for sessions II and III

Indianapolis, IN - The Custom Electronic Design and Installation Association (CEDIA) recently completed its first CEDIA Boot Camp for 2002 at the new CEDIA Training Center in Indianapolis. The three-day training course armed custom electronic installers, designers and manufacturers with the most up-to-date custom installation techniques.

CEDIA Boot Camp, launched in 1997, provides comprehensive hands-on training for new hires and veterans who have a professional interest in the custom electronic design and installation industry, with the added opportunity to achieve CEDIA certification through the Installer Level 1 Exam. Participants gain powerful insight on everything from wiring basics to writing winning proposals, to the latest in custom installation and low voltage techniques. The course and skills-based training, designed by some of the industry's most experienced installers, combine short lectures with hands-on workshops. Key concepts, definitions, techniques and procedures are drilled repeatedly throughout the course.

Due to the hands-on nature of the material, registration for each CEDIA Boot Camp session is limited. Those interested in attending sessions II and III are encouraged to register on-line at www.cedia.org. Additional Boot Camp programs will be held in Indianapolis later this year.

"Qualified professionals are so important to our ever-growing industry. More and more employees are being hired for work ethics and personality and are then being trained in the field," said Nicholas Pasyanos, CEDIA's director of operations. "CEDIA Boot Camp is an important step in achieving a comprehensive education and training in the custom installation business. Not only is Boot Camp an ideal educational opportunity for new hires, but we are training manufacturers and veteran industry professionals with up-to-date and relevant industry techniques."

For additional information on CEDIA Boot Camp, including a training schedule and/or directions to the CEDIA Training Center, call 1-800-669-5329.

NESDA "Industry Angel" Program Reaches 100 Sponsorships

NESDA, the National Electronics Service Dealers Association, has announced that its Industry Angel sponsorship program has now reached 103 sponsorships, due to the generosity of 17 individual industry partners. These partners represent consumer electronics manufacturing, parts providers, test equipment, and third-party warranty administration.

NESDA announced that this sponsorship program would bring the service industry closer together in stronger support of servicers. The first consumer electronics industry major program sponsor to participate was Toshiba America Consumer Products. Since then, 16 additional industry organizations have become partners in the program. B&D Enterprises; Hitachi America Ltd./Home Electronics Division; JVC Company of America; Kenwood USA Corp.; LG-Zenith Service; Mitsubishi Digital Electronics America, Inc.; N.E.W.; Panasonic; Samsung Electronics America Inc.; Sencore ;Sharp Electronics Corp. Sony Electronics Inc.; Toshiba America Consumer Products Tritronics Inc.; Service Net; ecHUB, and ServiceBench.

Professional Servicers of California to Meet May 16-18

The Professional Servicers of California 48th convention will be held at the Doubletree Hotel, Orange County, CA. A full schedule of technical and business seminars for professional servicers will be held beginning Thursday, May 16.

Among the participating sponsors are: Andrews Electronics, BSH Home Appliances, Coast Appliance Parts, Key Prestige, Lowers.com, Mitsubishi, N.E.W., Panasonic, Philips, PTS Electronics, Rubin Insurance, Sencore, Service Bench, VAC, and Whirlpool. For more information call: 714-995-8605.

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FOR SALE

Sencore VA62A Video Analyzer with all manuals and probes, excellent condition $495. Price includes shipping U.P.S. in USA. Leroy Blalock 4728 Devil Tr. Ground Road, Bear Creek, NC, 27207. Phone: 919-837-5632 before 2 pm eastern time.

B&K Model 467 picture tube checker and rejuvenator. Excellent condition, used very little. Also have latest manuals and setup charts. Sockets and universal adapter for checking any picture tube. Price $250. Call Gordon Lane, tel: 615-889-6195, 239 Jacksonian Drive, Hermitoge, TN. 37076.

Retired electronics technician selling all test equipment. 1-SC61 Sencore oscilloscope $450, 1-VC93 Sencore VCR analyzer $650, 1-VA48 Sencore video analyzer $185, 1-PR57 Sencore variac isolation $165, 1-CRT Tester Rejuvenator $85, 1-RF signal generator $65, 1-Transistor Tester $65, 1-laboratory oscilloscope 5" $45, 1-service bench VTVM $45, 1-tube tester portable $45, 2-microfiches 24x and 32x, $85, contact Jose Navarro 305-266-5153 email, jose.m.navarro@worldnet.att.net, Any offer with reasonable prices will be considered.

Sencore HA2500 Horizontal Circuit Analyzer $800, Sencore TF46 cricket Transistor Tester $100, Sencore CM2125 Computer Monitor Analyzer w/EX220x10 Output Expander Module $1,400. All units like new w/original box, manuals, schematics and cables. Joseph Burtzel, 1-800-658-2500 ext. 104, 1240 Oak St. Wabasso, MN. 56293-0217.

Sencore SG165 AM-FM Stereo Analyzer. Owners Manuals and leads, $350. Band K 60 MHz Dual trace oscilloscope #2160. With leads and Manual paid $900 sell for $325. Contact Mark at (541) 267-0628 Audio Video Specialists Coos Bay, OR.

Sencore SC3100, CM2125 with all adapters, HA2500, CR7000, TC100 Advance Monitor Service Course. All in original boxes. Never used. Call Rudy @ (518) 883-3334 or rnb@superior.net.

Photofacts AR9, AR48, AR49 and AR70 each $5.00 plus shipping, Eico model 239 Solid State Fet-TVM meter with leads and manual $40.00 plus shipping, Demodulation Probe for Eico 239 $10.00 plus shipping. T. Walton, 6322 Indian Path, San Angelo, Texas 76901, phone (915) 947-3393.

Small residual of a Radio-TV repair business from the 50's & 60's. 1volt, 6v and 12 volt tubes. Also, 1 Zenith picture tube, type 25vcnp22, BRAND NEW still in the box. Will give a list in detail. Best Offer takes all. Call 215-699-9646 may have to leave message. E-mail krider@bucks.edu.

Sencore SC3100 scope, $800.00. Sencore PR570, $400.00. Sencore HP200 HV probe, $25.00. Items like new, hardly used. Call Sam (916) 655-3365.

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Tuned SIG Tracer $20, 500w Stancor isolation xfomer $40, 40K HI E-meter (heath) $25, Car Buffs — charging sy-tester, ignition tester, Digital Analyzer all 3 for $90, 5IV SS 10mhz scope $125. Leonard Duschenchuk 1519A NW Amherst Drive, Pt. St. Lucie, FL 34986-2445. (561) 871-5831.

Radios, test equipment, literature, tubes. Must sell due to health problems. Send $2.38 S.A.S.E. Paul M. Williams, 2364 Beaver Valley Pike, New Providence, PA 17560-9622, (717) 786-3803.

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Wanted to buy. Diehl Mark 4 and Diehl Mark 7 Testers, also Service Manual for Philips Magnavox-Model 25TR15-C122 Copy or buy. Murray's Repair Service, 561-966-8862.

Schematic and Service Manuel for a Mita DC-2254 Copier. Neville W. Young, 214 East Robertson Street, Brandon, FL 33511. 813-685-1900.

Hand held remote control for RCA Model #GLR641TR. George Fogelman, 1201 Idlewilde El Paso, TX 79925, 915-778-0997.

Service Manual or copy for Altec Lansing AM-FM Rcvr. Model 714A. Richard Gilman, P.O. Box 633, King City, CA 93930, 831-385-9248.

Anything associated with the RCA SELECTAVISION CED VIDEODISC PLAYER. The Needle Pickup Video System developed and Marketed in the early 80's. Players, Parts, Remotes, Service Manuals, Advertising Memorabilia, Service Fixtures, Test Jugs, etc. Anything for the following brands: RCA, Zenith, Wards, Realistic and Hitachi. Tell what you have and I will make a offer! Email dj3928@aol.com or write to; Darrell Johnson, 11247 Hardinsburg Road, Cecilia, KY 42724.

Looking for B@K Oscilliscopes Models 1590, 1590A and 1570 working or not. Please call or write if you have one of these to sell. Contact Mike Shelton CET, 2708 May Dr., Burlington, NC 27215 or 336-229-5671 or email ke41gx@netpath.net.

Onkyo Tuner Amp. I need a power amp STK4913. Contact Mike at (757) 672-6199 Cell. Home (767) 482-4527.

Sony DM22 (#123561011) B+ regulator module, 834-00361 Zenith FF/Rewidler. Country Roads TV, 6831 W. Potter Rd. Bear Lake, MI 49814. Fax: 231-864-3988, Phone: 231-864-2446.

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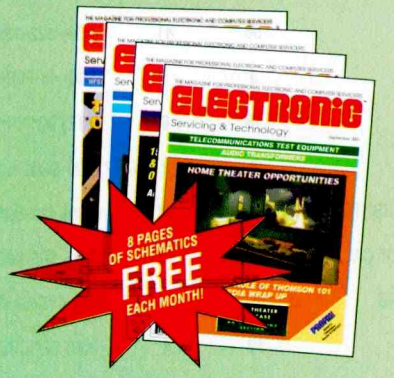

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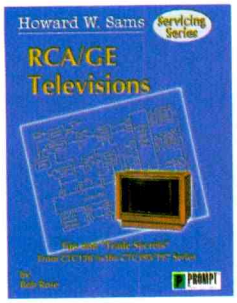

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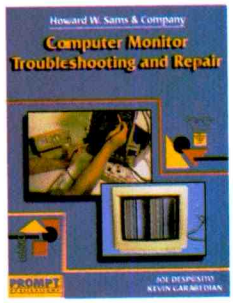

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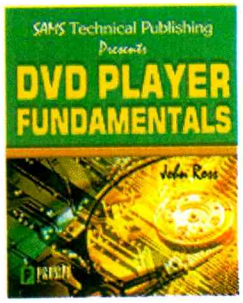

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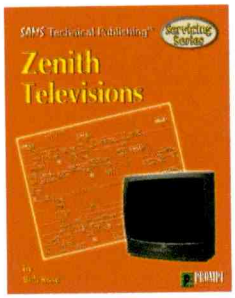

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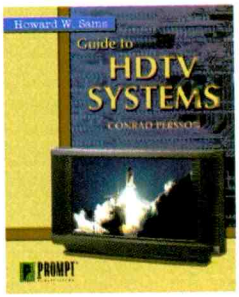

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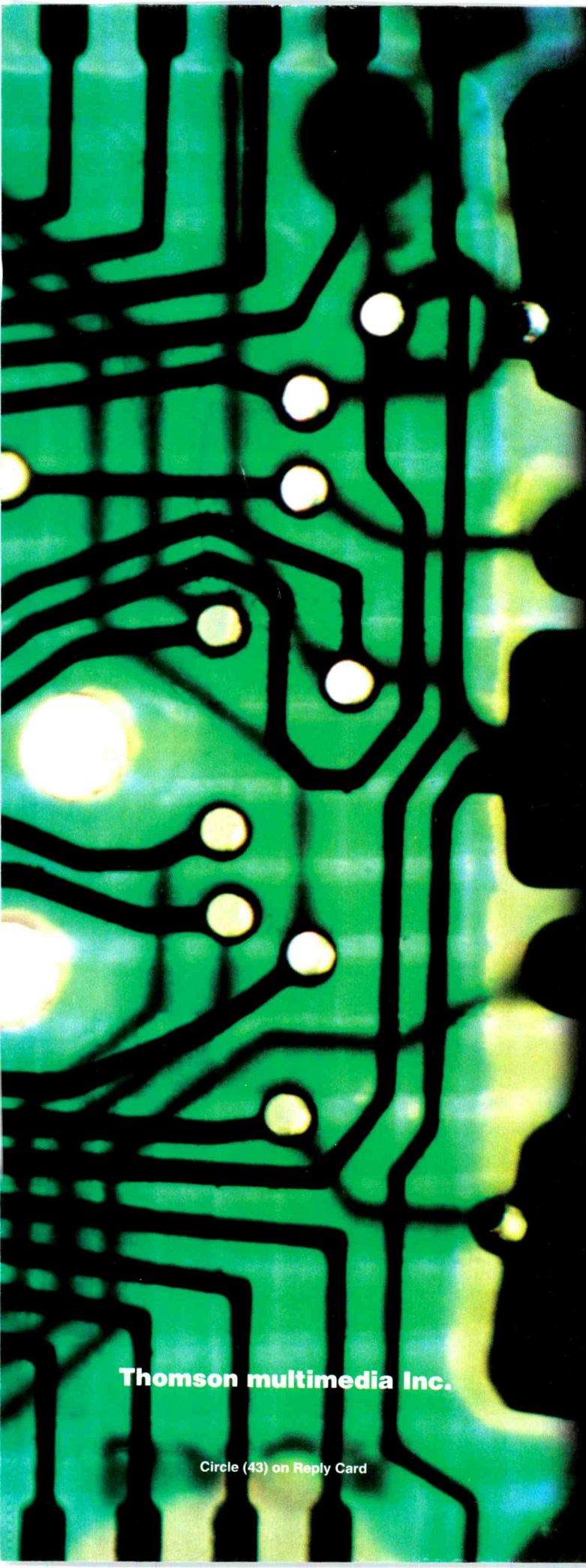

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